harvard school of public health

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HARVARD SCHOOL OF PUBLIC HEALTH

Announcement of Courses
and General Information

1978-79

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677 Huntington Avenue, Boston, Massachusetts 02115

OFFICIAL REGISTER OF HARVARD UNIVERSITY

These publications include the report of the president; the general catalog issue; the announcements of the College and the several professional schools of the University; the courses of instruction; the pamphlets of the several departments; and the like.

Every effort is made to insure that the information contained in this catalog is accurate at the time of publication. However, the School of Public Health reserves the right to make changes without notice in tuition and fees, admission and degree requirements, courses of instruction, and any other information contained herein.

As a matter of policy, Harvard University does not discriminate among applicants and students in admissions, educational policies, scholarship and loan programs, and athletic and other programs on the basis of race, religion, sex, national origin, color, creed, handicap, or age.

Credit for photograph on title page: Balthazar Korab.

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ACADEMIC CALENDAR, 1978-79

*September 12, Tuesday	Opening orientation session and preliminary registration for new international students
*September 13, Wednesday	Opening orientation session and preliminary registration for new U.S. students

Students previously enrolled may register any day during the period from Tuesday, September 12, through Friday, September 15, 1978.

The period between the opening sessions and September 18 will be devoted to orientation lectures, individual conferences with faculty members, and selection of courses of study.

Fall Term, September 18, 1978, through January 19, 1979

September 18, Monday	First period courses begin
October 9, Monday	Columbus Day: a holiday
November 10, Friday	First period ends
November 13, Monday	Second period courses begin
November 23 and 24 Thursday and Friday	Thanksgiving recess

Recess from Sunday, December 17, 1978, through Tuesday, January 2, 1979

January 8, Monday through January 12, Friday	Spring term registration period
January 19, Friday	Second period courses end
January 22, Monday through January 26, Friday	Supervised special studies or field observations

Spring Term, January 29, 1979, through June 7, 1979

January 29, Monday	Third period courses begin
February 19, Monday	Washington's Birthday: a holiday
March 23, Friday	Third period ends

*All new students are required to attend the opening session and to be present for the registration period.

Recess from Sunday, March 25, 1979, through Sunday, April 1, 1979

April 2, Monday	Fourth period courses begin
May 25, Friday	Fourth period ends
May 28, Monday	Memorial Day: a holiday
May 29, Tuesday through June 6, Wednesday	Post-class period
June 7, Thursday	Commencement

ADMINISTRATION OF THE UNIVERSITY

President and Fellows of Harvard College

(This Board is commonly known as the Corporation.)

Derek Curtis Bok, A.B., J.D., A.M., LL.D., *President*
Francis Hardon Burr, A.B., LL.B., *Senior Fellow of Harvard College*
Hugh Calkins, A.B., LL.B., *Fellow of Harvard College*
John Morton Blum, A.B., A.M., Ph.D., *Fellow of Harvard College*
Charles Pence Slichter, A.B., A.M., Ph.D., *Fellow of Harvard College*
Robert Gregg Stone, Jr., A.B., *Fellow of Harvard College*
George Putnam, A.B., M.B.A., *Treasurer of Harvard College*
Robert Shenton, A.B., M.B.A., Ph.D., *Secretary to the Corporation*
Frances Mary Gabron, *Assistant Secretary to the Corporation*

ADMINISTRATION OF THE SCHOOL OF PUBLIC HEALTH

Administrative Officers

Derek Curtis Bok, A.B., J.D., A.M., LL.D., *President*
Howard Haym Hiatt, M.D., *Dean of the Faculty of Public Health*
James Laverre Whittenberger, S.B., M.D., A.M. (hon.), *Associate Dean of the Faculty of Public Health*
Michael James Farmer, A.B., M.B.A., *Associate Dean for Policy and Resources*
Jeannette Jane Simmons, S.B., M.P.H., S.D. in Hyg., *Assistant Dean for Students*
Howard Jules Levy, S.B., S.M., M.B.A., *Assistant Dean for Financial Affairs*
Laura LaBelle Hall, A.B., M.B.A., *Assistant Dean for Development*
Richard Clark Killin, A.B., LL.B., *Special Assistant to the Dean*
Roger Benham Spaulding, A.B., *Special Assistant to the Dean*
Emily Kramer Morrison, S.B., *Assistant to the Dean*
Jay Andrew Winsten, A.B., Ph.D., *Assistant to the Dean*
Thora Haysey Stukas, A.B., *Director of Admissions*
Charlotte Marie Robinson, A.B., *Registrar*
Margaret Catherine Salmon, S.B., *Assistant to the Dean for Faculty Administration and Director of Financial Aid*
Raymond Kenneth Neff, A.B., S.M. in Hyg., S.D. in Bio., *Director of the Health Sciences Computing Facility*
Shirley A. Chessler, B.A., *Director of Administrative Services*
Marianne Fields Thomas, B.A., A.M., *Personnel Officer*
Cordelia Ellen Swain, A.B., *Publications Coordinator*
James Joseph Feeney, A.B., M.D., *Director of the Medical Area Health Service*
C. Robin LeSueur, A.B., B.S.W., M.L.S., *Librarian, Francis A. Countway Library of Medicine*

Administrative Board

Derek C. Bok, *President (ex officio)*
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Howard S. Frazier
Robert P. Geyer
Brian MacMahon
Dade W. Moeller
C. Frederick Mosteller
Thomas H. Weller
James L. Whittenberger

Joe D. Wray
Margaret C. Salmon, *Secretary*

Directors of Centers, Offices, and Special Programs

Howard Stanley Frazier, Ph.B., M.D., *Director of the Center for the Analysis of Health Practices*

Nathan Keyfitz, B.Sc., Ph.D., *Acting Director of the Center for Population Studies*

Thomas Huckle Weller, A.B., S.M., M.D., LL.D., *Director of the Center for the Prevention of Infectious Diseases*

James Laverre Whittenberger, S.B., M.D., A.M. (hon.), *Director of the Kresge Center for Environmental Health*

H. Richard Nesson, A.B., M.D., *Director of the Office of Extramural Health Programs*

Joe David Wray, A.B., M.D., M.P.H., *Director of the Office of International Health*

Marc Jeffrey Roberts, A.B., Ph.D., *Director of the Office of Executive Programs in Health Policy and Management*

Donald Frederick Hornig, S.B., Ph.D., *Director of Interdisciplinary Programs in Health*

The Harvard School of Public Health

The educational programs of the School of Public Health are directed primarily toward those whose careers are or will be concerned with improving the health of population groups through service, teaching, and/or research.

Public health as a profession evolved from the early combination of medical science and engineering for the control of environmental hazards. The field has grown to embrace applications of various facets of the natural, mathematical, and social sciences as community aspects of health problems have become more complex and demanding. Promotion of the public health now depends upon the skills and knowledge of members of several professions. The role of a graduate school of public health today is to prepare those who will be concerned with health problems which exceed the scope of any single discipline. Many of these problems can best be approached through the skillful cooperation of specialists from the fields of medicine, statistics, epidemiology, engineering, management, public policy, law, economics, sociology, chemistry, biology, and others.

HISTORY OF THE SCHOOL

Professional education in public health had been steadily increasing in Harvard University for more than two decades before the actual founding of the School in 1922. Its gradual development was characterized by certain important steps, the first of which was the establishment, in 1909, of the Department of Preventive Medicine and Hygiene in the Medical School — the first such department in the United States. The degree of Doctor of Public Health was first conferred in 1911. In that year a Department of Sanitary Engineering was established in the Graduate School of Engineering. In 1913, the Department of Tropical Medicine and, in 1918, the Division of Industrial Hygiene, with clinical and laboratory facilities, were organized in the Harvard Medical School.

Also in 1913, the Harvard–Massachusetts Institute of Technology School for Health Officers was formed under the joint management of Harvard University and the Massachusetts Institute of Technology. This School operated until the fall of 1922, when it was superseded by the Harvard School of Public Health, made possible by an endowment for this purpose from the Rockefeller Foundation.

In the early years of the School's operation, several of its departments functioned as joint departments with counterparts in the Medical School, sharing facilities, faculty, and budgets. In 1946, the School was separated administratively and financially from the Medical School and became an autonomous unit of Harvard University. It continues to cooperate with the Medical School in teaching and research, and has also developed close associations with other divisions of the University, particularly the Graduate School of Arts and Sciences, the John F. Kennedy School of Government, and the Graduate School of Business Administration.

OBJECTIVES OF THE SCHOOL

The objectives of the School are the advancement of knowledge and graduate education in the relevant disciplines and problem areas of public health. In its efforts to advance knowledge, the School is concerned with health problems of major importance to society, not only in technologically advanced regions, but also in economically disadvantaged areas.

The educational programs of the School offer instruction in the community-oriented health sciences and in the techniques of administration for able men and women who have potential for imaginative leadership. In addition to the education of physicians and other professionals, high priority is given to the postbaccalaureate preparation of young people for health careers. The School also provides opportunities for graduate students in law, business, government, education, and other fields to prepare for application of their special skills to health problems. Finally, increased emphasis is being given to the development of short, nondegree programs for active health professionals seeking midcareer educational opportunities.

In its involvement in the contemporary health problems of society, the School collaborates with community leaders in seeking ways in which knowledge can be effectively used for the advancement of human health. The School has forged and is strengthening links with outside health facilities to provide settings for training and research analogous to those available to medical students and faculty in teaching hospitals. For example, faculty members are now helping to develop several comprehensive health care programs both here and in developing countries. These are designed not only to improve serv-

ices available to local populations, but also to serve as sites for education and research.

The School participates in both professional and graduate education and offers the degrees of Master and Doctor of Public Health, Master and Doctor of Science, and Master of Industrial Health.

LOCATION AND RESOURCES

The main buildings of the School are the Health Sciences Laboratories at 665 Huntington Avenue, and the Sebastian S. Kresge Educational Facilities Building at 677 Huntington Avenue, Boston. These buildings are near the Harvard Medical and Dental Schools; the Countway Library of Medicine; the Children's Hospital Medical Center; the Beth Israel, Peter Bent Brigham, and Women's Hospitals; and other Harvard-affiliated hospitals. The School, including its Center for Population Studies, also has offices in Cambridge.

Health Sciences Computing Facility

Computing and data processing resources are available to students through the Health Sciences Computing Facility (HSCF), which is operated by the School of Public Health. A staff of computer programmers and analysts assists researchers and students from all of the Harvard Medical Area institutions in using the computer as a tool for analyzing data, for doing extensive numerical calculations, and for acquiring, maintaining, and processing large data bases.

HSCF is equipped with unit record machines, including a variety of card punching machines. Remote batch processing computing is accomplished by a high-speed telephone link to the IBM 370/168 computer at the Massachusetts Institute of Technology. Interactive computing (time-sharing) capability is provided by low-speed terminals which are connected to several large computers in the New England area, notably the IBM 370/168 at the Massachusetts Institute of Technology and the Honeywell 66/40 at Dartmouth College.

HSCF is also equipped with two time-sharing computers, a PDP 11/70 and a PDP 11/34. The PDP 11/70 can accommodate up to forty-eight simultaneous users, has an industry-compatible magnetic tape unit, and uses the UNIX operating system. The PDP 11/34 uses the MIIS operating system, which is a commercially available version of the widely used MUMPS system. It can accommodate up to sixteen simultaneous users and features a number of medical information

programs, a "computerized" teaching program, and specialized medical and health data bases. Low-speed teleprinter and video terminals are available in the School to allow students, faculty, and staff to have access to these computers.

HSCF staff members participate in several computing courses given by the Department of Biostatistics. There are also special tutorials (Biostatistics 313a,b,c,d) for interested students who have had prior computing experience. The Director of the HSCF is Dr. Raymond K. Neff.

Libraries

The library needs of the School are served principally by the Francis A. Countway Library of Medicine, located at 10 Shattuck Street. The Countway Library combines the resources and services of the Harvard Medical Library and the Boston Medical Library. Among libraries serving medical and health-related schools, it is the largest in the country, with recorded holdings of more than 460,000 volumes and 4,800 periodicals. The Countway Library also has extensive collections of historical materials, dating from the fifteenth century. Its history of medicine department provides modern facilities for the use of these books and other rarities.

All members of the University may borrow from the Harvard College library at Cambridge. Messenger service is provided daily between the college library, various other Harvard University libraries, and the Countway Library. The Boston Public Library, libraries of the Massachusetts Institute of Technology, and other libraries of the Boston area add to the total book and periodical resources available to students.

Other Resources

Students at the School may enroll in courses in other divisions of Harvard University, e.g., in the natural sciences, public administration, economics and other social sciences, statistics, and medical sciences. Many graduate courses at the Massachusetts Institute of Technology are also open to students at the School. Students will generally be granted credit for such courses toward degrees being earned at the School of Public Health, with the exception of courses in foreign languages. Credit granted for cross-registered courses may not exceed one-half of the credit units required for the degree in question.

The School maintains a close association with a wide variety of health, medical care, and welfare organizations in Massachusetts and elsewhere. The facilities of hospitals and certain other institutions adjacent to the School are available to qualified students. Other local, national, and international health facilities provide opportunities for observation and special studies, and members of their staffs are available to assist in the School's educational program. The State Laboratory Institute of the Massachusetts Department of Public Health offers opportunities for qualified students to obtain experience in laboratory methods pertinent to public health.

CENTERS AND OFFICES

Center for the Analysis of Health Practices

The Center for the Analysis of Health Practices is a University-wide unit devoted to the multidisciplinary investigation of problems related to health. It brings together members of the Faculties of Public Health, Medicine, Government, Law, and Arts and Sciences whose research interests concern medical economics, medical technology, health services, and medical practices. In each of these broad subject areas, questions are posed at the levels of efficacy, cost-effectiveness, and public policy.

Members of the Center are affiliated with most of the major teaching hospitals of the Harvard Medical School, as well as the Harvard Community Health Plan. In addition, through consulting or collaborative arrangements, members work with components of federal and state governments and other health-related institutions.

The Center sponsors, with the Department of Biostatistics, a biweekly program of Seminars in Health and Medicine. Students are encouraged to join with faculty members and representatives from other institutions in working groups that spend one or more academic years considering such topics as the assessment of diagnostic and other clinical procedures, development of indices of health status, evaluation of surgical risks, statistical analyses of large data sets, and examination of ethical issues in medicine. In addition, there are occasional opportunities for students to work with members of the Center on individual research projects.

The Director of the Center is Howard S. Frazier, M.D.; Associate Directors are Peter Braun, M.D., and Herbert Sherman, D.E.E.

Center for Population Studies

The Center for Population Studies was established in 1964 under the leadership of the School of Public Health, as a University-wide Center to join scholars and scientists in different fields in a common approach to human population problems. The members and research associates of the Center are drawn from the Departments of Biology, Economics, Government, and Sociology; the Division of Applied Sciences; and the Schools of Public Health, Design, Education, Medicine, and Divinity. The Center is located at 9 Bow Street, Cambridge.

In the School of Public Health, the Department of Population Sciences welcomes qualified candidates for the various degrees offered by the School. Courses open to all qualified students are also given by members of the Center in the Department of General Education and in the other parts of the University listed above.

The present research programs of the Center and the Department focus on several themes: laboratory and clinical research programs in human reproductive biology; economic, social, and environmental determinants and consequences of population change in America and other developed and developing countries, including public health aspects of fertility and the balance between populations and their resources; problems of urbanization and internal migration in both developed and developing countries; theories of population kinematics and dynamics and their implications for public policy; political and ethical aspects of population policy; historical population studies; population education; and adolescent growth and menarche.

The Acting Director of the Center is Nathan Keyfitz, Ph.D.

Center for the Prevention of Infectious Diseases

The Center for the Prevention of Infectious Diseases comprises the Departments of Microbiology and Tropical Public Health. Working in close collaboration, the staffs of the two Departments are concerned with the broad spectrum of agents, i.e., viral, rickettsial, chlamydial, bacterial, mycotic, protozoal, and helminthic entities, that parasitize man and with their relevant arthropod and molluscan vectors.

On a global basis the infectious diseases remain a primary cause of mortality. In the developed areas of the world, morbidity attributable to infectious diseases persists as a major impediment to the enjoy-

ment of health. An increasing number of chronic degenerative diseases are recognized as stemming from the insults of prior infectious processes. In many societies, acceptance of the concept of population control awaits containment of undue mortality induced by the infectious diseases and the consequent assurance that children who are born will have a reasonable prospect of achieving maturity. Considerations such as the foregoing emphasize the continuing need for the public health expert to possess knowledge of the rapidly changing technology of the control of infectious diseases, as well as basic knowledge concerning the attributes and epidemiologic characteristics of the responsible agents.

The faculty of the Center for the Prevention of Infectious Diseases work together to discharge a common responsibility for multidisciplinary instruction in the various facets of diseases of infectious etiology. The formal course offerings of the two Departments are designed and scheduled to permit the acquisition of a broad basic knowledge of infectious diseases as well as an introduction to specialized subject areas. For qualified advanced students, concentration in specific areas with participation in collaborative or individual research is encouraged at both predoctoral and postdoctoral levels. The wide variety of current research projects in the Center permits acquisition of experience both at home and abroad, in the laboratory or in the field. Training grant funds may be available for the support of qualified individuals specifically interested in the study of virology, parasitology, rickettsiae, chlamydiae, and tropical medicine in relation to public health.

The Director of the Center is Thomas H. Weller, M.D.; the Associate Director is Roger L. Nichols, M.D.

The Kresge Center for Environmental Health

This Center includes the Departments of Physiology, Sanitary Engineering, and Environmental Health Sciences. The Center serves as a focus for environmental health activities within the School of Public Health. Full-time faculty within the Center include physicians, engineers, physiologists, mathematicians, toxicologists, chemists, physicists, and other professionals. This diversity enables the staff to deal effectively with environmental problems which require a multidisciplinary approach.

Specific categories in which the Center conducts research and training include:

1. Air pollution effects and control
2. Environmental and industrial toxicology
3. Radiation biology
4. Medical radiological physics
5. Industrial hygiene
6. Occupational medicine
7. Radiological health (radiation protection)
8. Respiratory physiology
9. Sanitary engineering
10. Environmental health management

Degree programs include the Master of Public Health, Master of Science, Master of Industrial Health, Doctor of Science, and Doctor of Public Health. Formal requirements for each of these degrees are outlined in other sections of the catalog. Students interested in any of the above areas ordinarily enroll in the School of Public Health. Students whose primary interest is in problems of water quality and water resources generally enroll in the Division of Applied Sciences of the Graduate School of Arts and Sciences.

The Director of the Kresge Center is James L. Whittenberger, M.D. The Associate Director is Dade W. Moeller, Ph.D.

Office of Extramural Health Programs

The Office of Extramural Health Programs has established and is strengthening working relationships with components of the health system, including governmental agencies, providers of health services, and organizations of consumers. A principal objective is to provide training positions for students and research opportunities for faculty in operating health agencies and organizations outside the academic setting.

Working relationships with a wide spectrum of providers, payors, and regulators have developed into a unique blend of technical assistance, education, and research. The Office is currently involved in a major joint effort with the Peter Bent Brigham Hospital and the Affiliated Hospitals Center to develop an innovative service and training program in primary medical care and health services administration.

The Director of the Office is H. Richard Nesson, M.D.

Office of International Health

The School provides opportunities for preparation for careers in teaching, research, and service in international health. Various programs available within the School, together with related course offerings in other divisions of Harvard University and the Massachusetts Institute of Technology, offer students a broad background for future careers with international agencies, mission groups, philanthropic foundations, and foreign governmental and academic institutions. Cross-registration opportunities are available for students interested in medicine, economics, public administration, education, anthropology, government, social relations, and related subjects appropriate to particular regions of the world. (Students may also cross-register for courses in foreign languages, but may not receive credit for such courses toward degrees being earned at the School.)

The Office of International Health exists to advise students from overseas and U.S. students with interests in international health in the selection of appropriate programs and courses. The Director of the Office is Joe D. Wray, M.D., M.P.H., assisted by Gretchen M. Berggren, M.D., S.M. in Hyg., and Richard A. Cash, M.D., M.P.H.

MIDCAREER EDUCATION

The School offers a variety of midcareer education programs and short courses for practicing health professionals. Most of these programs are offered through Executive Programs in Health Policy and Management (described below); short courses in various aspects of environmental health and other areas are also available.

Executive Programs in Health Policy and Management

Executive Programs in Health Policy and Management was established in 1974 to develop and conduct educational programs for executives engaged in management and regulation in the health and environmental fields. The programs are residential and range in length from three days to six weeks. The short programs focus on specific topics or roles, such as finance or trusteeship; the longer programs focus on management skills and policy analysis. Participants in these midcareer programs are managers, policy makers, regulators, and planners who are sponsored by their employer organiza-

tions in the health and environmental quality fields. A core faculty is drawn from the Harvard School of Public Health; representatives from the Harvard Faculties of Business, Government, Law, and Arts and Sciences also teach in the programs. The programs are taught primarily by the case method, which requires the active involvement of the participants in the analysis of problem situations and the development of solutions to them.

Participation in Executive Programs is applicable to the A.M.A.'s Physician Recognition Award Category I Credit.

The Director of Executive Programs is Marc J. Roberts, Ph.D., Professor of Political Economy and Health Policy.

Admission and General Information for Students

APPLICATION FOR ADMISSION

Applicants must submit the following for consideration by the Committee on Admissions and Degrees: (1) completed application form; (2) transcripts of academic record at college, graduate school, and/or professional school; (3) names of at least three people, well acquainted with the applicant's previous work, from whom letters of recommendation have been requested. In addition, the Graduate Record Examination is required of certain applicants, as noted elsewhere in this catalog.

An application fee of $25, which is not refundable, is required for each formal application. A check drawn on a bank in the United States, a postal money order, or an international money order, payable to the Harvard School of Public Health, must accompany the application.

In addition to fulfilling the specific requirements for admission to a degree program, applicants must satisfy the Committee on Admissions and Degrees as to their ability to undertake advanced study at a graduate level. The final decision as to the admissibility of an applicant rests with the Committee.

The School is unable to accept all who are eligible for admission. Therefore, persons who wish to be considered for admission must submit their applications by *February first* prior to the academic year in which they wish to enroll. Spring term applications are not encouraged, because of the sequence of course offerings at the School. Candidates seeking admission in the spring term should first contact the department or program of interest to determine whether application for admission at that time is permissible.

Admission of a candidate is for a particular year; if enrollment at that time is not possible, reapplication is necessary and will be considered on the same competitive basis as a new application.

As a matter of policy, Harvard University does not discriminate among applicants and students in admissions, educational policies, scholarship and loan programs, and athletic and other programs on the basis of race, religion, sex, national origin, color, creed, handicap, or age. The School encourages women and members of minority

groups to apply for admission. Increasing numbers of students with disabilities are enrolling at Harvard and are participating in a wide range of programs and activities. Everything possible will be done to meet special needs. There are, however, no separate academic programs for either the physically handicapped or for students with learning disabilities; all enrolled students undertake the same program. A faculty coordinator has been designated to assist handicapped students and employees in adapting to life at the School.

International Students

Language Proficiency. Applicants from countries in which the language of instruction is not English must satisfy the Committee on Admissions and Degrees as to their ability to speak, read, write, and understand the English language competently. The applicant should have sufficient knowledge of English to enable him to understand lectures in English, to participate in seminar discussions, and to write examinations. In the absence of sufficient evidence from the sponsoring agency and other sources, the School will request that the applicant take and pass satisfactorily the Test of English as a Foreign Language. The test is administered four times a year at centers throughout the world. Applicants are advised to take this test as early as possible in the admissions process. Information concerning the test may be obtained by writing to the Test of English as a Foreign Language, Box 899, Princeton, New Jersey 08540. Certification of English proficiency must be received by the School before the immigration form needed to obtain a visa to enter the United States can be issued to the student.

Financial Certification. The School has adopted the following policy regarding foreign nationals who are applying for admission from outside the United States. An applicant whose financial support is not guaranteed by an official U.S. agency or foundation must submit evidence satisfactory to the School that he will have sufficient funds available in U.S. currency to enable him to pay his expenses for the full period of his academic program, and that he is permitted to exchange or export these funds. Certification of adequate financial resources must be received by the School before the immigration form needed to obtain a visa to enter the United States can be issued. Foreign students who are wholly supported by personal funds will be required to have adequate funds on deposit in a U.S. bank before the immigration form will be issued.

Foreign nationals admitted to the School and already residing within the United States will also be required to submit satisfactory evidence of sufficient funds to cover their expenses for the full period of their academic program. Such students will not be permitted to register at the School unless certification of adequate financial resources has been received.

An estimate of living expenses in the Boston area may be found in the section entitled "Living Expenses" on page 27.

Hospital Insurance. All nonimmigrant foreign students are required to enroll in the Harvard Blue Cross/Blue Shield student insurance plan. More information about the plan is included in the section entitled "Registration and Tuition" below.

All inquiries and communications regarding admission should be addressed to the Director of Admissions, Harvard School of Public Health, 677 Huntington Avenue, Boston, Massachusetts 02115.

PART-TIME DEGREE CANDIDATES

Students may register as part-time degree candidates with the approval of the Committee on Admissions and Degrees. Ordinarily this requires half-time attendance. A one-year program may be completed in two academic years, a two-year program in three academic years. Ten credit units per term constitute a regular program for half-time students. Half-time students may register for no more than 12.5 credit units per term.

REQUIREMENTS FOR NONDEGREE STATUS

Courtesy Students

Persons holding Harvard Corporation appointments are permitted to enroll in courses at the School with the permission of the instructor and the Registrar. Harvard employees should consult the Personnel Office about the provisions of the Harvard Tuition Assistance Plan. Employees from other hospitals and universities participating in tuition plans should consult the Registrar about the availability of space in courses of interest to them. Courtesy students may take a maximum of five credits per semester.

Special Students

The School may accept a few students who are not degree candidates. Procedures and requirements for the admission of such students are the same as for degree candidates. Admission of these special students to courses is subject to availability of space and the permission of the instructor. Candidates should specify on the application form the courses they plan to take. Admission as a special student carries with it no commitment to accept the applicant as a degree candidate and is limited to one academic year. Special students who wish to be admitted to degree candidacy must reapply and will be considered on the same basis as other applicants for admission.

After admission to degree candidacy, students may petition the Committee on Admissions and Degrees to count toward academic requirements courses taken as a special student or courtesy student (i.e., while in nondegree status). Permission may be granted if the courses fit into the student's academic program. Students who are granted such permission must still meet the tuition requirements for the degree. (See pp. 24-27 for tuition guidelines.)

CREDIT ASSIGNMENT

Credit units are assigned on the basis of the total amount of time required by a course, both in class and outside of class. Twenty credit units constitute a full program for one term. A full-time student may register for no more than 25 credit units per semester unless permission is obtained from the Committee on Admissions and Degrees.

REGISTRATION AND TUITION

Tuition and Fee Schedule

The tuition fees for the academic year 1978-79 are listed below:

Full tuition	$4,600*
Half-time full tuition	2,400*
Reduced tuition	2,450*
Half-time reduced tuition	1,325*
Doctoral facilities fee (resident)	550*
Nonresident doctoral guidance fee	200

Active file fee for degree candidates on leave of absence	20
Part-time special students enrolled for 6 to 9 credit units per term:	
First credit unit of work per term	210*
Each additional credit unit	110
Part-time special students enrolled for 5 or fewer credit units per term:	
Charge per credit unit per term	110
Degree candidates who register and receive credit for research or supervised study during the 1979 summer session:	
Five-credit program	550

The starred amounts include the University Health Service fee for medical care for all resident students enrolled for 6 or more credit units. This fee may not be waived. University Health Service coverage extends from September 1 through August 31.

Hospital insurance is billed separately. A Blue Cross/Blue Shield student insurance plan provides coverage for many costs of medical care not offered at the University Health Services. Coverage under this plan extends from September 1 through August 31. The premium for 1978-79 is $160. The Blue Cross/Blue Shield student insurance plan is compulsory for all nonimmigrant foreign students; all other students are also enrolled in the plan unless they have other adequate medical insurance and submit a waiver within two weeks following registration. Waivers are approved by the Director of the University Health Services.

It should be noted that nonresident doctoral students are not eligible to participate in any Harvard health plan.

Payment of Fees

Bills for tuition and fees will be issued and payable as follows:

Student term bill worksheets for the fall term will be issued on August 1, and will be payable *in full* by August 20.

Bills for the spring term will be issued in early January, and will be payable *in full* by January 25.

Payments may be scheduled over monthly installments (four each term) through an optional payment plan that is available at a service charge of $15 per term.

A student who leaves the School during the academic year is responsible for tuition charges in accordance with the following:

Leaves by		*Percent of Total*
First Term	*Second Term*	*Semester Charges*
October 25	February 25	25%
November 25	March 25	50%
December 24	April 25	75%

Students leaving after December 24 and April 25 of the first and second terms, respectively, are responsible for full tuition charges.

Students who are candidates for degrees must have paid all bills to the University at least one day before the day upon which the degrees are to be voted.

A student who leaves the University for any reason whatever must pay all charges against him immediately upon receipt of a bill from the Office of Fiscal Services. Every student is held responsible for the payment of fees until he has notified the Dean of his intention to withdraw from the School.

All term bills are sent to the student at his local address unless the Office of Fiscal Services is requested in writing to send them elsewhere.

Any student whose indebtedness to the University remains unpaid on the date fixed for payment is deprived of the privileges of the University. Reinstatement is obtained only by consent of the Dean of the School in which the student is enrolled after payment of all indebtedness and a reinstatement fee of $10. As a further condition of reinstatement, the student is required to file with the Office of Fiscal Services a bond in the amount of $1000 as security for the payment of future term bills.

Registration and Tuition Guidelines

The following guidelines for payment of tuition apply as stated to all students who enroll at the School of Public Health for the first time on or after September 1, 1978. The guidelines also apply to students enrolled at the School before that date, with the exception of certain aspects of the policy concerning payment of tuition by doctoral candidates. Information concerning the applicability of the guidelines to students enrolled prior to September 1, 1978, can be obtained from the Registrar's Office.

Degree Candidates. After admission to the School of Public Health and until fulfillment of requirements for the degree, all degree candidates must be registered continuously in one of the following registration categories:

1. Resident students
2. Nonresident doctoral students
3. Students on leave of absence

All degree candidates must pay the appropriate tuition rate for each registration period as described below; they may not pay tuition on a "per credit" basis. It should be noted that, in order to qualify for deferment of an educational loan, a student must be registered for no less than a half-time study program.

1. *Resident Students*: All degree candidates who are enrolled in courses or who intend to use any Harvard academic facilities for an extended period of time must register as resident students.

   Students who are registered in a master's degree program in the School will be charged full tuition.

   Students who are registered in a doctoral degree program in the School will be charged full tuition for two years (with up to one year of credit for full tuition paid as a master's degree candidate at the School), followed by one year of reduced tuition.* For subsequent terms of enrollment the facilities fee will be charged, which provides for full access to Harvard academic facilities and the University Health Services, and for the issuance of a Harvard resident identification card.

2. *Nonresident Doctoral Students*: Doctoral students who no longer reside in the Greater Boston area** and who are engaged in less than half-time work on the degree must apply to the Registrar for permission to register as nonresident students *in absentia.* Such permission requires the approval of the student's department and of the Committee on Admissions and Degrees (CAD), and is granted for no more than two registration periods at a time; permission for renewal must be requested in writing by the student. Students in this category will normally have

*The length of time students must pay tuition at a certain rate will be suitably adjusted for students registered for less than full time.

**Students residing within a 50-mile radius of downtown Boston will normally be considered resident for tuition purposes.

completed payment of at least the required two years of doctoral full tuition before applying for *in absentia* status; they must in any case complete this payment prior to their graduation.

Doctoral students *in absentia* are charged the nonresident doctoral guidance fee, which covers periodic consultation with the student's doctoral adviser but does not provide for the use of Harvard facilities (including participation in any of the Harvard health plans) or for the issuance of a Harvard identification card. Also, as noted above, a student registered for less than a half-time study program may not qualify for deferment of an educational loan. Upon expiration (or earlier termination) of CAD permission for *in absentia* status, or for a term in which use of Harvard facilities is required, the appropriate resident rate will be charged.

3. *Students on Leave of Absence*: Degree candidates who will not, during a given registration period, be engaged in study or research for a degree from the School, and who will be making no use of Harvard facilities, must apply to the Registrar for a leave of absence. Leaves of absence are ordinarily granted for a maximum of two registration periods and require approval of the student's department and of the CAD.

   Students on leave of absence are required to pay the active file fee to maintain their degree candidacy. Upon expiration (or earlier termination) of CAD permission for leave of absence, students will be charged the appropriate tuition rate.

Termination of Degree Candidacy. Students who do not intend to register in any one of the categories noted above must terminate their candidacy for the degree. Such students are required: (1) to file in the Registrar's Office a written notice of intent to withdraw; (2) to inform their department; and (3) to arrange an exit interview with the Financial Aid Office, when appropriate. If students do not terminate their degree candidacy formally but fail to register for a full term or longer, degree candidacy will be terminated automatically.

The CAD, with departmental recommendation, may terminate a student's degree candidacy on the basis of unsatisfactory performance in coursework. Candidacy also will ordinarily be terminated in the case of a student who has exceeded the five-year limit for completion of degree requirements following successful completion of the oral qualifying examination. Doctoral candidacy may be terminated

as a result of failure to submit an acceptable proposal for the thesis. Also, the Faculty Council may recommend termination of candidacy in matters involving academic discipline.

A student who wishes to reactivate degree candidacy should file an application for readmission, which must be approved by the department and by the CAD. Prior to readmission, the student must pay any outstanding bills to the University, as well as the then-current active file fee for each registration period that has elapsed since the termination of candidacy.

Nondegree Candidates. Requirements for admission to nondegree programs are described on pp. 21-22.

Special students registered for full-time or for half-time study programs will pay the corresponding full tuition rate; those registered for less than half time will pay tuition on a "per credit" basis as outlined in the tuition and fee schedule.

Field Studies

Field opportunities, listed under each department's course offerings and bearing the course number 330, often entail travel expenses that must be met by the student. Information about estimated expenses should be obtained from the appropriate department.

LIVING EXPENSES

Living costs in the Boston area are higher than in most areas from which students come. The following are *minimum* amounts estimated that students will need in order to cover expenses for approximately nine months. A single person will need at least $9,500, in addition to travel expenses, to cover the cost of tuition and health insurance ($4,760), rent ($2,700), and other living expenses ($2,040). A family of four will need at least $15,500, in addition to travel expenses, to cover the cost of tuition and health insurance ($4,760), rent ($3,500), and other living expenses ($7,240), including medical care.

FELLOWSHIPS AND LOANS

The Harvard School of Public Health is a participant in the Harvard University Federally Insured Student Loan Program. This program

permits a student who either is a U.S. citizen or has immigrant status to borrow up to $5,000 a year, providing the student has less than $15,000 in outstanding loans.

Some fellowship support is available through departments and special programs from federal and nonfederal sources for qualified students in a variety of fields. In addition, there is a limited amount of funds available under the National Defense Student Loan Program.

As a matter of policy, the Harvard School of Public Health does not discriminate among applicants and students in fellowship and loan programs on the basis of race, religion, sex, national origin, color, creed, handicap, or age.

Detailed information about fellowships and loans can be obtained by writing to Ms. Margaret C. Salmon, Director of Financial Aid, Harvard School of Public Health, 677 Huntington Avenue, Boston, Massachusetts 02115.

HOUSING

The Henry Lee Shattuck International House is an apartment residence operated on a nonprofit basis by the School for its full-time students and their families from the United States and abroad. Located at 199, 203, and 207 Park Drive, within walking distance from the School, the House consists of sixty-five individual apartments, each with its own kitchenette and bath.

All apartments are rented furnished with basic items except for linens, blankets, and kitchen utensils, and are leased for the academic year, September 1 through June 30. No unfurnished units are provided. Special arrangements can be made for July and August. The monthly rent charge includes all utilities — hot water, heat, gas, and electricity — but not telephone service.

Applications should be submitted by May 15, although late applications will be considered as long as space is available. For application forms and more detailed information, write to the Director, Shattuck International House, Harvard School of Public Health, 677 Huntington Avenue, Boston, Massachusetts 02115.

In addition to its other services, the School's Office of Student and Alumni Affairs maintains an up-to-date list of real estate agencies in Boston and the surrounding areas.

The Harvard University Housing Office in Cambridge arranges for housing in University-owned complexes. Information and application forms may be obtained by writing to the Harvard University Housing Office, 7 Holyoke Street, Cambridge, Massachusetts 02138. A copy of the student's letter of acceptance from the School should be enclosed to prove affiliation. This Office also maintains listings of apartments and houses not owned by the University. These listings must be viewed in person; information is not given out by mail or telephone.

STUDENT HEALTH SERVICE

Under the University Health and Insurance Plan, students at the School of Public Health receive medical care and insurance toward hospital expenses. Medical care is provided through the facilities of the Medical Area Health Service, located in Vanderbilt Hall. The hospitalization insurance extends for a period of twelve months from September 1, and covers hospitalization in Boston and elsewhere. Research and teaching fellows who are in a training status are required to enroll in the Student Health Plan unless they can show that they have comparable coverage.

A prepaid program for the care of spouses (including maternity benefits) and children of full-time students is available. As the plan provides extensive benefits for ambulatory and inpatient care, all who are eligible are strongly advised to enroll. Its coverage, like that of the Student Plan, extends for a period of twelve months from September 1, and provides full semiprivate hospitalization benefits. A descriptive brochure about the plan for dependents is sent to students before registration or may be obtained from the Registrar.

Any illness necessitating absence from classes should be reported to the Medical Area Health Service Office by the student or an attending physician, and to the Registrar's Office at the School. A physician from the Medical Area Health Service, on call twenty-four hours a day, can be reached through the switchboard of Harvard University.

For further information, contact the Director, Medical Area Health Service, 275 Longwood Avenue, Boston, Massachusetts 02115. (Telephone: (617) 732-1370).

OFFICE OF STUDENT AND ALUMNI AFFAIRS

The Office of Student and Alumni Affairs is concerned with many aspects of student life. The staff works with other groups and individuals to identify the special needs of students, plan orientation, publish the student directory, and arrange for student-faculty discussions and social events. Student recruitment activities are coordinated by staff in this Office. Up-to-date information is maintained about real estate agencies, child-care facilities, transportation, and athletic outlets in the Medical Area, elsewhere in Boston, and in Cambridge.

The Office administers a Student Placement Resource Center where reference material, position opportunity notebooks, and a list of alumni contacts are provided. The Office contacts potential employers to acquaint them with programs at the School and to request information about job openings. Current positions (permanent, summer, and part-time) are posted. Students are assisted in writing resumes, arranging for interviews, and exploring career opportunities. The Office's activities complement the efforts of departments, programs, and faculty advisers. Data collected about positions and salaries of graduates are available to prospective students.

Further information can be obtained from the Office of Student and Alumni Affairs, Harvard School of Public Health, 677 Huntington Avenue, Boston, Massachusetts 02115.

PROTECTION OF RIGHTS AND PRIVACY OF STUDENTS

The School of Public Health has adopted policies and procedures in compliance with The Family Education Rights and Privacy Act of 1974, which is commonly referred to as "the Buckley Amendment." Copies may be obtained from the Registrar's Office, Room G-4, 677 Huntington Avenue.

The Buckley Amendment was designed to protect the privacy of student educational records, afford students and former students the right to inspect the records that directly concern them, and provide students and former students the right to question and challenge the content of their educational records through formal hearings.

If a student believes that the School has failed to comply with the provisions of this amendment, or of the implementing regulations, he

or she may file a complaint with The Family Education Rights and Privacy Act Office, the Department of Health, Education, and Welfare, Washington, D.C.

The School annually publishes a student directory with the names of students, their pictures, countries of residence, degrees and years received, colleges and universities attended, programs of concentration, and local addresses. Any student not wishing any of this information included in the directory should inform the Associate Dean for Student and Alumni Affairs to such effect, in writing, within four weeks following the start of the fall term.

ACADEMIC INTEGRITY

As in all academic institutions, the School expects its members to maintain high standards of ethical conduct and personal integrity. This unwritten honor code governs examinations, term papers, and all other aspects of graduate student performance. Any violation of these standards of ethical behavior constitutes potential grounds for expulsion from the School.

Admission and Degree Requirements and Academic Programs

The School of Public Health offers programs leading to the graduate degrees of *Master of Public Health* (M.P.H.), *Doctor of Public Health* (Dr.P.H.), *Master of Industrial Health* (M.I.H.), *Master of Science* in a specified field (S.M. in . . .), and *Doctor of Science* in a specified field (S.D. in . . .). The general degree requirements and the respective requirements for admission are discussed in the following sections.

MASTER OF PUBLIC HEALTH

The program leading to the Master of Public Health degree consists of one academic year of study designed to prepare existing health professionals for careers in public health practice. The program provides a broad background in various disciplines basic to public health. Through the choice of elective courses beyond the basic area requirements, students may acquire a general knowledge of several areas or may pursue in some depth one or more areas of particular relevance to their career goals.

Requirements for Admission

Applicants to the M.P.H. program must satisfy the Committee on Admissions and Degrees as to their academic ability, the relevance of their previous education and experience, and their overall qualifications for graduate professional education in public health. Ordinarily, an applicant should hold a doctoral degree in medicine, dentistry, or veterinary medicine. Consideration is also given to applicants who hold doctoral degrees in biology, behavioral sciences, other natural sciences and social sciences, law, economics, engineering, and certain related fields regarded by the School as appropriate background for entrance into the public health profession.

Students currently enrolled in an M.D. or D.M.D. program may apply for admission to the M.P.H. program, provided that a joint program can be arranged that meets the approval of both the Committee on Admissions and Degrees and the institution from which the doctoral

degree is being earned. Ordinarily, such students are concurrently enrolled at the Harvard Medical School or the Harvard School of Dental Medicine, but occasionally students from other schools of medicine or dentistry are able to arrange similar programs. For students in a joint degree program, the M.P.H. degree will be conferred in the term in which the doctoral degree is awarded.

In very exceptional instances, consideration for admission to the M.P.H. program may be given to an applicant who holds a master's degree, or, more rarely, a baccalaureate degree, with a highly distinguished academic record, coupled with substantial professional experience in public health or related fields. These applicants must be able to demonstrate sufficient knowledge and competence to satisfy the Committee on Admissions and Degrees as to their qualifications for professional public health education and may be required to submit scores for the Aptitude Test of the Graduate Record Examination.

Requirements for the Degree

An M.P.H. degree candidate must spend one academic year in residence at the University and must successfully complete courses totaling a minimum of 40 credit units, at least half of which must be earned at the Harvard School of Public Health. Each M.P.H. student's program must include courses that represent adequate coverage in three basic areas of public health, as outlined below. The extent of coverage in these areas must meet the approval of the Master of Public Health Program Committee.

In a given student's program, no single course shall satisfy the requirement in more than one of the following areas:

1. Fundamental knowledge and concepts about man, with particular attention to his interaction with the (1) physical, (2) biological, and (3) social (including psychological) environment, and the effects of that interaction on his health. *Study programs will ordinarily include introductory courses in at least two of these three subareas.*
2. Basic techniques of investigation, measurement, and evaluation, with emphasis on their use in understanding health in human communities. *Study programs will ordinarily include the introductory courses in biostatistics and epidemiology.*
3. Basic approaches to policy planning and program management

and their application to the promotion of community health within the social, economic, and political setting relevant to health services. *Study programs will ordinarily include one of the introductory courses in health services administration.*

Master of Public Health Program Committee

The Master of Public Health Program Committee is composed of three coordinators, a faculty representative of each department at the School, and representatives of students, alumni, and the School administration. The coordinators and committee oversee all M.P.H. programs, including admissions, and are responsible for developing long-range plans for the objectives and content of the M.P.H. program. No changes are anticipated in the requirements for the M.P.H. degree for the academic year 1978-79.

DOCTOR OF PUBLIC HEALTH

The Doctor of Public Health is an advanced professional degree for those who intend to pursue academic or research careers in public health, including administrative, planning, or evaluation roles in public health practice. The degree is granted on successful completion of an approved program of independent and original investigation in a special field of public health and the presentation of the results of this research in an acceptable thesis.

Requirements for Admission

An applicant for admission to candidacy for the Doctor of Public Health degree normally must be a graduate of an approved school of medicine, dental medicine, or veterinary medicine. Depending on the intended field of specialization, consideration may also be given to a candidate who holds an advanced degree in one of the disciplines basic to public health. In addition, the applicant must hold, or be in progress toward, the degree of Master of Public Health, or its equivalent, from an approved institution.

Applicants must be able to satisfy the Committee on Admissions and Degrees as to their overall qualifications for doctoral study at the School and must demonstrate potential ability to undertake original investigation in a special field. Scores for the Aptitude Test of the Graduate Record Examination must be submitted by all applicants except those with previously earned doctoral degrees.

Requirements for the Degree

Formal requirements for the Doctor of Public Health degree are the same as those for the Doctor of Science degree. A brief summary of these requirements appears on pp. 39-41.

MASTER OF INDUSTRIAL HEALTH

The program leading to the Master of Industrial Health degree is designed to provide physicians with postgraduate training in the public health disciplines that are relevant to the development of preventive medical programs in industry. This one-year degree program may be taken as part of a two-year approved residency in occupational medicine, or it may be taken as an independent one-year program.

Requirements for Admission

Candidates must be graduates of an approved school of medicine and must satisfy the Committee on Admissions and Degrees as to their scholastic ability to study at the graduate level. Students from the United States must have completed an internship or residency of at least twelve months in a hospital approved by the American Medical Association.

Requirements for the Degree

Candidates for the M.I.H. degree must spend one academic year in residence at the University and must successfully complete a program of at least 40 credit units, comprising both required and elective courses.

All candidates are expected to take the following courses unless they can demonstrate equivalent preparation:

1. Biostatistics 101a,b, Principles of Biostatistics (5 credits)
2. Epidemiology 201a, Principles of Epidemiology (2.5 credits)
3. Environmental Health Interdepartmental 201a,201b, Principles of Environmental Health (5 credits)
4. *Either* Environmental Health Sciences 271a,b, Introduction to Radiation Protection (5 credits) *or* Physiology 207c,d, Radiation Biology (4 credits)
5. Environmental Health Interdepartmental 207c,d, Policy Issues in Occupational Health (5 credits)

6. Environmental Health Interdepartmental 251c,d, Basic Problems in Occupational Health and Industrial Environments (5 credits)

The total number of credits in required courses is thus either 26.5 or 27.5, depending on whether Environmental Health Sciences 271a,b or Physiology 207c,d is elected. Additional courses may be selected from the curriculum approved for residencies in occupational medicine.

MASTER AND DOCTOR OF SCIENCE IN SPECIFIED FIELD

The School offers programs leading to the degrees of Master and (in most cases) Doctor of Science in designated fields of concentration. The prospective applicant should note that in some areas, the Master of Science program is intended primarily or wholly as preparation for doctoral study; applicants are screened for their interest in, and potential for, doctoral work, and the majority of students continue on for the Doctor of Science degree. In other areas, the Master of Science is viewed primarily or wholly as a terminal degree; while a small percentage of students may continue on for the doctorate, the majority discontinue study upon receipt of the S.M. degree. Finally, students in still other areas are divided roughly equally between those who go on to earn the Doctor of Science and those who discontinue their studies upon receipt of the S.M. degree.

The Master of Science and Doctor of Science degrees currently conferred by the School include:

Master and Doctor of Science in Behavioral Sciences
Master and Doctor of Science in Biostatistics
Master and Doctor of Science in Environmental Health Sciences
Master and Doctor of Science in Epidemiology
Master of Science in Health Policy and Management*
Master and Doctor of Science in Health Services Administration
Master and Doctor of Science in Maternal and Child Health
Master and Doctor of Science in Microbiology
Master and Doctor of Science in Nutrition

*The Program in Health Policy and Management is a terminal program for all students; no doctoral degree is offered in this area.

Master and Doctor of Science in Physiology
Master and Doctor of Science in Population Sciences
Master and Doctor of Science in Tropical Public Health

Occasionally, a student may be admitted to a master's program or to candidacy for a doctoral degree in more than one of the above disciplines, if the program meets the requirements of the respective departments or programs involved. In such instances, the degree conferred specifies the areas.

Because there is considerable variability among the S.M. and S.D. programs in different fields, both in their overall goals and their specific admission and degree requirements, students are urged to consult the program descriptions that appear at the end of this section of the catalog, after the general statements concerning the S.M. and S.D. programs. These descriptions provide basic information about programs in specific areas; additional information may be obtained by contacting the respective departments or programs, as indicated in the degree designation.

Master of Science in Specified Field

In general, the programs leading to the degree of Master of Science in a specified field of concentration are designed for students with interests in the scientific basis of public health and preventive medicine. The degree is granted upon fulfillment of a program of advanced work in one of the public health disciplines represented by departments and certain programs in the School. Students may be admitted to either a one- or a two-year master's program, depending upon the requirements of the particular program. Information about requirements for one- and two-year programs in various areas is included in the program descriptions that appear later in this part of the catalog.

Requirements for Admission. Applicants to Master of Science degree programs must satisfy the Committee on Admissions and Degrees as to their overall qualifications and promise for successful graduate study at the School. Applicants must also satisfy the department or program to which admission is sought that they have an adequate academic and/or professional background appropriate for specialization in that field.

Conditions of eligibility for one-year or two-year programs vary with the area or department in which a student wishes to specialize. Pro-

spective applicants should consult program descriptions for more specific information.

Generally, eligibility for admission to a one-year program is limited to graduates of approved schools of medicine, dentistry, or veterinary medicine, or to applicants who have earned doctoral or, for some programs, master's degrees in fields acceptable to the department(s) to which admission is sought. Applicants holding master's degrees may be considered for admission to one-year or to two-year programs, depending upon their prior educational and professional background and upon the particular requirements of the program to which they wish to apply.

An applicant holding a baccalaureate degree is normally considered for admission to a two-year program, in order to complete the requirements for a Master of Science degree. For a few programs, including industrial hygiene, air pollution control, and radiological health, applicants may be considered for a one-year program if they hold a bachelor's degree with adequate scientific and engineering training and if they have had at least two years of relevant professional experience in the field of specialization.

Occasionally, a year or more of appropriate graduate work in an approved institution may enable a student to fulfill two-year program requirements in one year. In some cases, however, program requirements are such that a student must spend one-and-a-half or two years in residence in order to complete the necessary courses, regardless of his prior training and experience.

All candidates for admission to a Master of Science program are required to submit scores for the Aptitude Test of the Graduate Record Examination unless they have previously earned doctoral degrees. An Advanced Test of the Graduate Record Examination may be required in some programs if the applicant's undergraduate major is in one of the following fields: biology, chemistry, economics, engineering, mathematics, physics, political science, psychology, or sociology. Applicants are advised to take the Graduate Record Examination no later than the December test administration date. In order to expedite the admissions process, applicants who have taken the Graduate Record Examination in a prior academic year are advised to send a photocopy of their own G.R.E. "Report to the Candidate" when returning their completed application form. An official score report must be received from the Educational Testing Service before final action will be taken on the application. Additional information con-

cerning the Graduate Record Examination requirement is included in the instructions accompanying the application form.

Requirements for the Degree. Students admitted to a one-year program must spend a minimum of one academic year in residence at the University and must successfully complete a program of at least 40 credit units. Students admitted to a two-year program must spend two academic years in residence and must successfully complete a program of at least 80 credit units.

While specific course requirements vary from program to program, all candidates for a Master of Science degree are required to take Biostatistics 101a,b and Epidemiology 201a, unless they can demonstrate equivalent preparation. Candidates who do not have a background in medicine or biology are advised to take Physiology 203a,b, or its equivalent, or a course in general biology elsewhere. Beyond these minimal course requirements, each program may specify additional courses that are necessary for satisfactory fulfillment of degree requirements in the particular area of specialization. These specific course requirements are generally *not* listed in this catalog. The student should consult with his adviser or department or program head about these requirements before deciding which courses to take.

Doctor of Science in Specified Field

The Doctor of Science degree is an advanced graduate degree for those who intend to pursue academic or research careers in public health. The degree is granted on successful completion of a program of independent and original research in one of the basic disciplines of public health, and upon the presentation of this research in an acceptable thesis.

Requirements for Admission. Applicants for admission to candidacy for a Doctor of Science degree must satisfy the Committee on Admissions and Degrees and the department of specialization as to their overall qualifications for doctoral study and their ability to undertake original research in their chosen field. All candidates for a Doctor of Science degree must hold a baccalaureate degree. In some instances, an applicant will be expected to complete the Master of Science degree at the School before being granted full admission to doctoral study. In such cases, the student will first be admitted to a Master of Science program. (It should be noted that scores for the Aptitude Test of the Graduate Record Examination must be submitted

as part of the admissions process by all applicants to doctoral programs except those with previously earned doctoral degrees.)

Because specific prerequisites vary with the discipline or field of specialization, prospective applicants are urged to consult the program descriptions in this catalog and the department or program to which admission is sought for more detailed information.

Requirements for the Degree. A minimum of two academic years of full-time study in residence at the University is required of students enrolled in the doctoral program. The required work and preparation of an acceptable thesis, however, frequently takes longer. Residence requirements are fulfilled by payment of tuition (see p. 22) and pursuit of an academic program approved by the department of concentration and the Committee on Admissions and Degrees (CAD).

The CAD is responsible for overseeing the programs of all doctoral students. During the registration period each new doctoral student will receive a manual detailing the principles and procedures that are to be followed. A brief summary of requirements is given below.

Each doctoral student is required to take 40 to 60 credits in graduate-level courses distributed over a major and two minor fields. Each minor field will ordinarily consist of at least 10 credits in formal courses. Such requirements may be reduced in cases of prior relevant coursework or experience. They may be increased in cases where there has been a substantial shift in field. Courses in the major and minor fields must be completed with distinction. Under the current grading system this means Honors or High Pass grades. Departments may stipulate specific course requirements and may require written and/or oral examinations on the coursework in the three fields.

By the end of the second year the student should be prepared to take the oral qualifying examination. The main emphasis of this examination is to assess the student's potential to perform research in his/her chosen field. Since most doctoral research in the School requires a substantive knowledge of more than one discipline or field, the examining committee will include faculty from disciplines representing the minor fields as well as the major. The examination will include questioning in the major and minor fields outside of the proposed research.

A research committee consisting of the student's adviser and other faculty members is to be appointed within one month after the qualifying examination is passed. This committee has the responsibility for guiding the student's research through to completion. It will meet

with the student at least once every six months to discuss details of the student's progress.

An acceptable thesis must ordinarily be submitted within five years of the date of registration as a doctoral candidate. The thesis should consist of one or more manuscripts suitable for publication in a scientific medium appropriate to the candidate's field. Detailed requirements are available from the Registrar.

The thesis will not be accepted until a public presentation and discussion has been held, with the research committee in attendance.

Three bound copies of the approved thesis must be in the Registrar's Office before the faculty will vote the degree at its special meetings in October, February, or June.

Occasionally thesis work will be performed away from the Eastern Massachusetts area, that is, *in absentia*. Before the doctoral subcommittee of the CAD grants such status, it is necessary that the research committee meet with the candidate to appraise the thesis plan. Agreement must be reached and the doctoral subcommittee must be advised in writing *before departure of the student* as to (1) acceptability and feasibility of the proposed thesis plan; (2) the timing and scope of the periodic written reports that will be required of the student; (3) arrangements that have been made or will be made for direct field supervision of the student; and (4) the minimum period of time the student will spend back at the School before the presentation and defense of the thesis. In no case will the doctoral subcommittee grant *in absentia* status for more than one year at a time.

Students wishing further information on doctoral program requirements should contact the Registrar's Office.

Additional information about Master and Doctor of Science programs in specific areas is included in the following program descriptions.

Programs in Behavioral Sciences

General Program in Behavioral Sciences. Geared to the individual interests of students, this program is designed to develop skills in applied behavioral sciences — e.g., medical sociology, psychosomatic medicine, methodology in behavioral techniques such as small-group processes — for use in administration and planning of health programs. The program is regarded as a terminal master's degree

program for the majority of students, but a significant number go on to earn the Doctor of Science in Behavioral Sciences degree. Those students who do not continue in a doctoral program generally take one year to earn the S.M. degree; most then assume nonresearch administrative positions.

Preferred candidates for admission to the program are physicians or persons with a minimum of a baccalaureate degree in the biological or social sciences. The curriculum is flexible, with considerable latitude for individual differences in the selection of courses and overall program design, although the majority of courses are elected from the offerings of the Department of Behavioral Sciences.

Psychiatric Epidemiology. The goals of this program are: (1) to train students in the methods of psychiatric epidemiology for use in basic and applied research, and (2) to develop the conceptual skills of mental health administrators in using psychiatric epidemiology in program planning, delivery, and evaluation of services. It is a one-year S.M. program, terminal for most graduates, of whom roughly half assume positions involving research and/or evaluation of programs, and half become involved in the administration of mental health services.

Candidates preferred for admission to the program hold an M.D. degree (preferably with a residency in psychiatry) or a Ph.D. degree in one of the related social sciences. Occasionally, students with master's degrees in psychology, sociology, or anthropology are accepted into the program.

Programs in Biostatistics

Preparation for careers in biostatistical research and teaching is the primary goal of both the Master and the Doctor of Science programs in biostatistics. Applicants to the master's program are screened for their potential for doctoral study, and many go on to earn the Doctor of Science degree. The programs are geared to students with a prior bachelor's degree who have extensive training in mathematics. Such students generally take two years to earn the S.M. degree. Occasionally students with a prior year of graduate work enroll and are able to earn the master's degree in one year. In some cases, students with particularly strong backgrounds may be admitted directly as provisional doctoral candidates and may take the doctoral qualifying examinations after adequate course work without taking the Master of Science degree.

Approximately half of the course work taken by most students consists of courses in statistics and epidemiology at the School of Public Health and at the Graduate School of Arts and Sciences. Other courses elected vary with the particular needs and background of individual students and their proposed areas of research. Before beginning doctoral research all candidates must pass qualifying examinations in the areas of biostatistics, mathematical statistics, and a field of application such as epidemiology, physiology, nutrition, or health services administration.

For students not immediately interested in a doctoral program, the Department of Biostatistics offers the two-year Master of Science degree. This may be combined with a program in another department. Both departments would be involved in the admission process and the development of suitable programs. All students earning a degree in biostatistics are expected to acquire proficiency in computing, data analysis, report writing, and teaching.

Programs in Environmental Health Sciences

There are five specialized programs offered by the Department of Environmental Health Sciences. Although an occasional student is admitted to a general program in environmental health sciences, for which courses may be planned to suit individual student interests and career goals, the majority of students elect one of the specialties described below.

Problem analyses and the evaluation and reporting of such analyses are expected to be major components of the work of health professionals who graduate from these programs. To assure the development of these skills, each student accepted into a two-year master's program will be required to conduct an appropriate research or related study and to present a written report on it at an acceptable professional level. Such studies and the associated reports will generally be completed during the second year of the program. The minimum time devoted to this effort will be 5 credit units per semester, for a total of 10 credit units.

After receipt of the Master of Science in Environmental Health Sciences degree, most students accept positions in government or in industry. Master of Science graduates who wish to pursue careers in teaching or in research often continue on for the Doctor of Science in Environmental Health Sciences degree. In general, students who

desire to pursue the doctoral degree immediately after completing the baccalaureate degree should plan to enroll in the Master of Science program first.

Air Pollution Control. This program provides preparation in the sciences basic to understanding air pollution research and control activities. The curriculum generally includes courses in community air pollution, meteorological aspects of air pollution, identification and measurement of air contaminants, air and gas cleaning, aerosol technology, and principles of toxicology. Upon receipt of the S.M. degree, most graduates secure positions with federal, state, or local regulatory agencies, with consulting firms, or with industry. A small number continue on for the Doctor of Science degree.

Acceptable candidates for the program normally have a bachelor's degree in engineering (preferably chemical engineering), chemistry, mathematics, or physics. Although the S.M. degree generally requires two years to complete, students with master's degrees in the forenamed disciplines, and some students with prior training or experience in related areas, may be able to complete the program in one year.

Environmental Health Management. The principal goal of the S.M. program in this field is to train professional public health personnel to manage environmental health problems, particularly in urban areas. The program is multidisciplinary and draws upon courses offered by the Harvard School of Public Health, by other faculties of Harvard University, and by the Massachusetts Institute of Technology. In addition to the basic course in environmental health management, students normally take a series of courses in air pollution control, industrial hygiene, radiological health (specialty areas offered through the Department of Environmental Health Sciences), or water pollution control (offered through the Division of Applied Sciences of the Graduate School of Arts and Sciences), supplemented by course work in environmental economics, public health administration, political and social sciences, environmental law, environmental planning, and health education.

This program is usually two years in length and generally includes a field training assignment with an environmental health agency during the intervening summer. Students admitted to the program normally hold a bachelor's degree in biology, engineering, geology, or another science. Upon receipt of the Master of Science degree, most students enter nonresearch positions in the environmental control field.

Industrial Hygiene. The master's program in industrial hygiene is designed to help meet the demand for professional personnel with the skills and scientific knowledge that are needed to identify and control health problems — e.g., air contamination, noise, radiation, heat, pressure — that exist in the workplace. It is a terminal program for most students, although a few continue on for the Doctor of Science degree. The curriculum generally includes recommended and/or required courses dealing with basic problems in occupational health and industrial environments, environmental control, identification and measurement of air contaminants, air and gas cleaning, principles of toxicology, and aerosol technology.

Acceptable candidates for the program normally have a bachelor's degree in engineering, chemistry, physics, or biology. Although this is primarily a two-year program, students with master's degrees in the above disciplines and some students with prior training or experience in related areas may be able to earn the S.M. degree in one year.

Radiological Health (Radiation Protection). Students in this program are provided with knowledge of the fundamentals of radiation protection. Considerable attention is given to the effects of environmental releases of radioactive materials, and the associated requirements for complying with regulations and standards. The curriculum includes recommended and/or required courses covering radiation protection, radiation biology, X-ray protection, aerosol technology, and radiation dosimetry.

Recipients of the S.M. and/or S.D. degrees are prepared for positions with the nuclear power industry, hospitals, universities, research institutions, governmental regulatory agencies, and consulting architectural or engineering firms. Students admitted typically have prior bachelor's or master's degrees in physics, mathematics, or engineering. Two years are normally required to earn the Master of Science in Environmental Health Sciences degree, although some students with prior training and/or experience in relevant areas may earn the degree in one year. About half of the students continue on for the Doctor of Science degree.

Medical Radiological Physics. This program is designed to provide students with a large portion of the knowledge and experience necessary for the practice of radiological physics in a hospital and for certification by the American Board of Radiology. Most students take two years to earn the Master of Science in Environmental Health Sciences degree, after which about half continue on for the doctoral

degree. Approximately half of the graduates of this program enter research careers; the remainder enter nonresearch careers, principally as radiological physicists in health-care settings. Program trainees normally have prior bachelor's or master's degrees in physics and mathematics.

The program utilizes the resources of the Harvard teaching hospitals and was designed in collaboration with the recently established Harvard-M.I.T. Program in Health Sciences and Technology. The curriculum draws upon courses within that program as well as courses offered within the Harvard School of Public Health. A typical curriculum might include recommended and/or required courses in radiation protection, radiation biology, X-ray protection, and physics in diagnostic radiology, nuclear medicine, and radiation therapy.

Programs in Epidemiology

One-Year Master of Science Program. A one-year program leading to the degree of Master of Science in Epidemiology is offered for physicians, veterinarians, and dentists. It is intended to provide students with basic skills in epidemiologic and quantitative methods and in computing, in preparation for research careers. The program usually includes most of the courses offered by the Department of Epidemiology, plus courses in principles of biostatistics, statistical methods in research, and computing principles and methods which are offered by the Department of Biostatistics (a total of 25 to 30 credit units). Additional formal courses in areas of special interest and/or supervised research comprise the remainder of the program. Approximately half of the S.M. degree recipients continue toward the doctorate. For the other half the degree may be considered terminal, and most of these students assume research or academic positions upon receipt of the Master of Science in Epidemiology.

Two-Year Master of Science Program. The two-year Master of Science program is designed for persons who hold a bachelor's degree and have a strong background in biology and mathematics. It is intended as preparation for doctoral study. In addition to the epidemiology and statistics courses listed under the one-year program, students take courses in basic medical sciences and the biological aspects of public health problems.

Doctor of Science Program. The Doctor of Science program is designed for persons who have completed the degree of Master of

Science or its equivalent and who plan to go on to do original research and to prepare for careers in teaching or research. Doctoral candidates are required to complete a minimum of one academic year in residence and will frequently be required to take additional formal course work in epidemiology or in fields related to their specific doctoral research plan. The required work and preparation of a thesis normally require at least two full years and usually longer.

Program in Health Policy and Management

The program leading to the degree of Master of Science in Health Policy and Management is an interdisciplinary, two-year program which prepares students for careers in health planning and regulation or in the administration of health programs and institutions. Students holding baccalaureate degrees with strong academic backgrounds in the natural or social sciences are eligible to apply. The program encourages application from candidates with prior training as health professionals and/or some work experience in the health field. All applicants must demonstrate ability to master the quantitative and analytical content of the program.

A set of core courses comprises less than half of each student's program. These courses cover basic health issues and institutions, quantitative methods, epidemiology, economics of health policies and programs, and sociological and historical perspectives on health care. Beyond the core courses, students may concentrate their studies in one of three ways: on policy skills; on management skills; or on a substantive health problem area, examining both planning and administrative aspects of that area. In addition to courses at the School of Public Health, students may select appropriate courses offered by other faculties at Harvard and by the Massachusetts Institute of Technology. Supervised field work (in the summer between years one and two and in the second year) is an integral part of the program. Students are exempted from required courses where they can demonstrate prior proficiency and, in exceptional circumstances, the period of study required for the degree may be reduced.

Programs in Health Services Administration

A one-year program is currently offered which leads to the degree of Master of Science in Health Services Administration. Its goal is to give students a broad understanding of the health services system

while developing their abilities to address issues and problems analytically and to carry out rational approaches to problem solving. The program is terminal for approximately two-thirds of the students, most of whom assume administrative positions upon receipt of the Master of Science in Health Services Administration degree. The remaining students continue in doctoral study and, upon receiving the Doctor of Science in Health Services Administration degree, generally enter academic and research careers.

The curriculum of the program is designed with sufficient flexibility to permit a student to direct his or her studies toward particular health areas. Courses offered by the division of health services administration of the Department of Health Services normally constitute a substantial portion of each student's program.

Admission requirements vary somewhat depending on whether the student intends to continue on for the Doctor of Science degree. Students who seek admission to the S.M. program but who do not intend to pursue doctoral study generally must hold a medical or dental degree or a master's or doctoral degree in disciplines related to health or administration, and preferably have had relevant work experience. Students without previous advanced degrees in a health field may be admitted to the S.M. program provided that they intend to continue on for the S.D. degree. In some cases, such students may be admitted directly as provisional doctoral candidates and may take the doctoral qualifying examinations after adequate course work without taking the S.M. degree.

Students who lack a previous health-related advanced degree and who do not wish to pursue doctoral study should generally apply for the two-year program in health policy and management described above.

Programs in Maternal and Child Health

The program leading to the degree of Master of Science in Maternal and Child Health is primarily a one-year program for students with prior master's degrees in nursing, social work, or nutrition, or M.D. degrees, preferably with professional experience in a public health agency or health-care program, or research experience in child growth and development. The program provides knowledge of the principles of administration of health services for mothers and children, and skills for determining needs, designing services, and planning health programs for mothers and children and for other special

groups (e.g., handicapped persons). It suits the needs of professionals who want to pursue an academic career or to focus in depth on a specific area such as school health or perinatal health.

Recipients of the S.M. degree enter both administrative and academic positions. Occasionally, a student continues on for the degree of Doctor of Science in Maternal and Child Health. Most students in the program elect basic courses offered by the divisions of maternal and child health and health services administration of the Department of Health Services. However, the curriculum is flexible, with latitude for course selection tailored to individual interests.

Programs in Microbiology

Educational programs of the Department of Microbiology are oriented toward training in research leading to the degree of Doctor of Science in Microbiology, with a specialization in a particular area. There are no programs leading to the Master of Science in Microbiology as the terminal degree.

Training is available in the areas of immunology, virology, cancer biology, and medical microbiology. At the doctoral level, major emphasis is placed on research training in these areas, and students are encouraged to develop strengths in related areas such as molecular biology and epidemiology. Prospective students should have a strong background in biology and chemistry. Previous training in microbiology, virology, and/or immunology is desirable but not necessary.

During the first and second years students take courses as required to establish a firm background in the appropriate areas. By the second year at the latest the student should be introduced to laboratory research, and should be formulating a thesis proposal for evaluation. Each student is expected to demonstrate a proficiency in laboratory techniques and an ability to reason through a research problem before undertaking doctoral research. These skills can be obtained by participation in laboratory courses and laboratory tutorials, as well as departmental and interdepartmental student and faculty seminars. Faculty research collaboration is underway with several laboratories outside the Department, and student participation in these programs is also encouraged.

Faculty research programs cover the areas of rickettsiae and chlamydiae, cellular immunology, viral oncology, immunochemistry, cancer biology and mutagenesis, water-borne viruses, and tumor

immunology. Doctoral candidates should select a specific research topic in one of these areas soon after admission to the program.

Programs in Nutrition

Laboratory-Oriented Doctor of Science Program. The laboratory-oriented doctoral program in nutrition may be entered at either the master's or the doctoral level. It is highly recommended that the latter route be selected, and indeed the Department of Nutrition may in certain instances exercise its own determination as to which option should apply. An excellent background in chemistry, biology, nutrition, or some other relevant science discipline is necessary for admission. Students are required to take courses in biochemistry, epidemiology, biostatistics, physiology, public health nutrition, biochemistry and physiology of nutrition, laboratory and animal research techniques, nutrition policy formation and program operation, and the departmental seminar. Electives pertinent to the student's interests are also taken. Tutorial research is begun during the first year.

Joint Concentration in Nutrition and Health Policy and Management. Students may earn the degree of Master of Science in Nutrition and Health Policy and Management by pursuing a two-year course of study focusing on both areas. Such students are required to take (1) the core courses in the Health Policy and Management Program (described earlier), and (2) courses in nutritional biochemistry for policy and management, foods and human nutrition, community and public health nutrition, and nutrition program design and evaluation.

Other Programs. Doctor of Science programs in (1) nutrition and epidemiology, and (2) the economics of agriculture, food, and nutrition are under consideration for introduction into the School's curriculum. Once finalized, descriptions and requirements of these programs will be made available. Interested students should contact the Department of Nutrition before applying.

Programs in Physiology

Environmental or Respiratory Physiology. This program is intended primarily for students with prior degrees in the physical sciences, or in biology with a strong physical science and mathematical component, who plan to continue toward a doctorate. The curriculum is aimed at providing students with substantive knowledge of respiratory physiology as a special field within organismic physiology, based on cell

biology, biochemistry, biophysics, and biomathematics. The program is also designed to assist students in developing skills necessary for performing research in respiratory mechanics, respiratory defense mechanisms, and pathophysiology of respiratory disease; these include skills in statistics, experimental design, bioinstrumentation, and computation.

Two years of residence at the School are generally required to earn the Master of Science in Physiology degree, after which most students continue on for the doctorate. Students with prior master's degrees in related areas may earn the S.M. degree in one year.

Radiobiology. Students admitted to the master's program in this area are expected to continue on for the Doctor of Science in Physiology degree, as the basis for research careers in radiation biology and experimental carcinogenesis. Criteria for admission include prior background in biology and/or physics. The master's portion of the program is designed to offer the academic preparation and develop the basic skills in laboratory techniques and data handling necessary for undertaking original research. For most students, two years are required to earn the Master of Science in Physiology degree, although some students with prior master's degrees in related areas (e.g., biology, radiation biology, biochemistry) may earn the degree in one year. Almost all students continue on for the doctorate; those who have discontinued study after receiving the S.M. degree have entered research- or service-oriented careers in radiological health.

Toxicology. The program in toxicology is intended primarily for students with recent baccalaureate degrees in biology or chemistry. During the two years required to earn the Master of Science in Physiology degree, students acquire systematic knowledge of the health implications of environmental chemicals, combined with the in-depth knowledge of basic biomedical sciences necessary for subsequent doctoral research in a specific area. Most of the students continue in doctoral study and enter research or academic careers upon receipt of the doctoral degree.

Occupational Medicine or Master of Industrial Health (M.I.H.). The program in occupational medicine is strictly a one-year program for physicians and may lead either to the degree of Master of Science in Physiology or to the Master of Industrial Health degree described elsewhere. The goal of the program is to prepare physicians for both theoretical and practical aspects of careers in occupational medicine as a special field of preventive medicine and public health. In one year

only part of this goal can be achieved — to provide the student with basic knowledge of industrial processes and hazards; illnesses and impairments associated with occupations; control of occupational hazards; and similar topics. Minimum skills are expected in epidemiologic and statistical methods, environmental assessment and monitoring, and related techniques.

The student is expected to continue in doctoral status or in residency training, primarily in epidemiologic aspects of occupational medicine. Upon completion of the residency phase, the student is eligible for certification by the American Board of Preventive Medicine.

Programs in Population Sciences

There is wide variability among the programs of individual candidates for the degrees of Master and Doctor of Science in Population Sciences, reflecting the diversity of the students' backgrounds, national origins, previous education, areas of professional concern, and career goals. Given these varied curriculum needs, the overall goals of the program are to develop sophistication in data and information management and evaluation, as well as to provide a broad philosophical perspective on problems and issues in the population field and on related issues of health and health care. Although the Department of Population Sciences offers a very flexible program, approximately half of the S.M. students are from or are primarily interested in health and population problems of LDCs. Areas of concentration within the Department include demography, population policy and planning, family planning programs, and reproductive biology.

Students with bachelor's degrees in biological and/or social sciences, or in other population-related fields, are generally expected to spend two years in residence toward the S.M. degree. Students with prior master's or higher degrees, or extensive work experience, generally complete study toward the S.M. degree in one year. Approximately one-fourth of those who complete the S.M. degree enter the doctoral program.

Programs in Tropical Public Health

Tropical Public Health. This one-year program leads to the degree of Master of Science in Tropical Public Health. It is designed for persons with prior medical degrees (M.D., D.V.M., D.M.D., D.D.S.) or

doctoral degrees in biomedical science who are interested in problems of infectious disease in developing countries. The program has the following goals: (1) to provide students who have adequate training in the health sciences with the additional background essential for careers in research or service in developing countries; (2) to introduce students to the significance, recognition, and prevention of the major infectious disease problems of developing countries; and (3) to introduce them to the factors influencing human ecology and social development in such areas.

Medical and Public Health Virology. The program in this area is geared to students with prior medical degrees, doctorates in microbiology or associated fields, or master's degrees in basic biological sciences, biology, or microbiology. Such students generally earn the Master of Science in Tropical Public Health degree in one year; students deficient in specific requisite areas may be required to spend a second year in residence to earn the master's degree.

The goals of the master's program are to provide familiarity with technical procedures needed in the study of immunopathogenesis of human viral pathogens, and to introduce students to problems of control of endemic and epidemic viral diseases in human populations. The program is regarded as preparation for doctoral study. Most students continue on to earn the Doctor of Science degree and enter careers in teaching and research in the area of medical virology.

Medical and Public Health Parasitology. Students with prior M.D. degrees or doctoral or master's degrees in biological or medical sciences are eligible for admission to this program. The exceptional candidate with a strong biological background but lacking a master's degree will be considered. For the student without prior preparation in pathology, biochemistry, and immunology, two years of course work are customarily required before the Master of Science in Tropical Public Health degree is awarded; students with sufficient prior preparation may earn the master's degree in one year.

The goals of the program are: (1) to acquaint the student with recent advances in the area of parasitic diseases and with the present status of such diseases throughout the world; (2) to develop skills for evaluation of the current literature and of control programs; and (3) to provide adequate background for conducting research on these diseases, including their biochemical and immunological aspects. The master's program is regarded as preparation for doctoral study. The majority of students go on to earn the degree of Doctor of Science in

Tropical Public Health and enter careers in research and teaching in the area of medical parasitology.

Ecology and Control of Vectors of Disease. Students admitted to this program normally have prior medical degrees or doctorates or master's degrees in biological or medical sciences. Most students take two years to earn the Master of Science in Tropical Public Health degree, although some students with previous education in relevant areas may earn the degree in one year. Almost all recipients of the master's degree continue on for the doctorate, in preparation for careers in teaching and research.

The specific educational goals of the program are: (1) to acquaint the student with the various arthropod and molluscan vectors of disease and to develop an appreciation of the biology of these organisms and the means for their control; (2) to prepare the student to plan and evaluate control programs; and (3) to develop skills with respect to identification, maintenance, and experimental procedures involving these organisms.

COMBINED DEGREE PROGRAMS WITH MEDICAL AND DENTAL SCHOOLS

In response to trends in medical school curricula and the increasing interest of medical students in community medicine and public health, the School offers admission to the Master of Public Health or Master of Science programs as part of a combined degree program. The medical or dental student admitted to this program can satisfy requirements for a public health degree within the four years usually required for the Doctor of Medicine or Doctor of Dental Medicine degree. Ordinarily, such students are concurrently enrolled at the Harvard Medical School or the Harvard School of Dental Medicine, but occasionally students from other schools of medicine and dentistry are able to arrange similar programs.

Students from medical schools other than Harvard normally enroll full time for an academic year, after completion of at least two years of medical school. Harvard students are eligible for consideration after completion of one year at the Medical School or the School of Dental Medicine. Such students usually enroll full time for the fall term of their third year and complete requirements for a public health degree either by enrolling full time in the spring term or by spreading their electives in public health over a longer period.

The Master of Public Health or Master of Science degree will be awarded by the Harvard School of Public Health in the term in which the candidate will receive the doctoral degree.

RESIDENCY FOR BOARD CERTIFICATION

The School offers approved residency training leading to certification by the American Board of Preventive Medicine in the following areas:

General Preventive Medicine, in the specialty areas of
- Epidemiology
- Health Services Administration

Occupational Medicine

Residency credit is given for one, two, or three years of study leading to one or more public health degrees. A residency may also include supervised experience which may or may not be part of a doctoral program.

Additional information about the residency programs may be obtained from Dr. Brian MacMahon, Head of the Department of Epidemiology (for the specialty area of epidemiology of the General Preventive Medicine residency); Dr. Alonzo Yerby, Professor of Health Services Administration (for the specialty area of health services administration of the General Preventive Medicine residency); and Dr. John Peters, Professor of Occupational Medicine (for the Occupational Medicine residency).

None of the residencies as such involves stipend or other financial support. Some financial support may be available through traineeships or National Research Service awards for degree programs (U.S. citizenship or permanent residence status required). Further information on financial aid can be obtained from the individuals listed above, or from Ms. Margaret C. Salmon, Director of Financial Aid.

POSTDOCTORAL FELLOWSHIP PROGRAM IN DENTAL PUBLIC HEALTH AND DENTAL CARE ORGANIZATION

The School of Dental Medicine, in cooperation with the School of Public Health and the Massachusetts Department of Public Health, offers a program covering three academic years of postdoctoral

study, intended to prepare a limited number of individuals for creative full-time teaching, research, or administrative careers in dental public health and dental care organization. Each person accepted into the program will be appointed as a Clinical or Research Fellow in Dental Care Organization at the School of Dental Medicine. The program is open to dentists, dental hygienists, and other qualified health professionals.

The program is in three parts of approximately one year each, which need not be completed in succession. One part of the program involves a formal course leading to a degree of Master of Public Health. Candidates with an M.P.H. or equivalent from another school, however, may be accepted into the program with one year advanced standing. The second portion involves a one-year supervised residency at the community, state, or national level in health policy and administration. This residency meets the requirements of the American Board of Dental Public Health. The third portion affords opportunity for advanced didactic work and research at the School of Dental Medicine, the School of Public Health, other departments of the University, and/or other institutions. Epidemiological or health services research can be carried on over the entire three-year period in a variety of situations involving either new or continued studies. A research thesis is prepared for presentation at the end of the third year.

Fellows in Dental Care Organization who wish to become candidates for a degree in public health must meet the admission requirements of and be accepted into the School of Public Health. Application should be made directly to the School of Dental Medicine, whose Committee on Postdoctoral Education will forward the applicant's file to the School of Public Health for consideration.

Upon successful completion of this program, the candidate may receive the M.P.H. degree from the School of Public Health, as well as a Certificate of Postdoctoral Study in Dental Care Organization and a certificate of completion of residency requirements from the Harvard School of Dental Medicine.

Academic study beyond the master's level may be arranged with the School of Public Health and other departments of the University.

For further information and application forms, write to the Head, Department of Dental Care Organization, Harvard School of Dental Medicine, 188 Longwood Avenue, Boston, Massachusetts 02115.

Departments and Courses of Instruction

In the course listings below, course numbers from 100 to 199 indicate undergraduate and graduate courses; numbers from 200 to 299 indicate primarily graduate courses; and numbers from 300 to 399 indicate graduate courses of reading and research.

The letters "a," "b," "c," "d," and "e" following the course number indicate the period(s) in which a course is given, with "a" denoting first period, "b" second period, "c" third period, and "d" fourth period. The letter "e" indicates supervised special studies or field observations, usually during the one-week period between fall and spring terms or during the post-class period following the spring term.

The credit assignment is given in units following the statement of number and length of sessions per week. The phrase "Additional credit may be arranged" indicates that the student may earn additional credit by attending supplementary class meetings, doing extra reading, or otherwise devoting additional time to the course.

INTERDEPARTMENTAL COURSES

Interdepartmental 201b. Historical Analysis of Public Health Policy and Practice: United States, 1900-1975

Lectures, section meetings. *Two 1½-hour sessions each week. 2.5 units.* Dr. Rosenkrantz.

This course identifies six issues to illustrate the relationship between social experience and professional responsibility for prevention of disease. Topics selected for analysis based on historical example illustrate policy-related issues: how health hazards are identified; determinants of resources; criteria of efficacy and equity in policy and services. The course is recommended for students who wish to relate their special competence to the network of objectives in public health.

Interdepartmental 202. Introduction to Instructional Design in the Health Fields

Self-instructional course, supplemented by small-group discussion. May be taken first or second period. 2 units. Dr. Segall.

This course introduces the student to a systems approach to instructional design. Students select health-related topics they would like to teach and develop instructional plans through application of the model. The approach includes analysis of professional performance and specification of objectives, instructional activities, and strategies for evaluation of process and outcome. Examples are taken from community medicine and public health, but the tools obtained are broadly applicable.

Enrollment is subject to the approval of the instructor.

Interdepartmental 203c. Course and Curriculum Development in the Health Fields

Self-instructional course, supplemented by small-group seminars. 2 units. Dr. Segall.

This is an advanced course recommended for students who currently hold

faculty appointments in health professions schools or training programs, or who anticipate such an appointment upon completion of their studies. Using the model for instructional design developed in Interdepartmental 202, students plan a complete course or segment of curriculum in an area of individual selection.

Prerequisite: Interdepartmental 202.

Enrollment is subject to the approval of the instructor.

Interdepartmental 204c,d. Seminars on Educational Policy

Seminars. *One 2-hour session each week; time to be arranged. 2 units. Additional credit may be arranged.*

Not given in 1978-79.

Seminars are offered on policy issues related to training programs in community medicine and public health for specific categories of health manpower, including physicians, dentists, and allied health professionals in the United States, and health professionals in developing countries. Through individual instruction and seminar discussions, students will assess the impact of professional expectations, social needs, and institutional constraints on the selection of educational goals.

Interdepartmental 208a,b. Human Rights in Health

Lectures. *One 2-hour session each week. 3 units.* Dr. Curran.

This course entails a comprehensive examination of human rights as they bear upon health programs, nationally and internationally. Among topics considered from ethical, cultural, and legal viewpoints are: rights to medical care and a healthy environment; equality; rights of medical patients, women, children, and experimental subjects; and problems of balancing personal rights and community protection.

Interdepartmental 209a,b. Health Services in Developing Countries

Seminars. *Two 2-hour sessions each week. 5 units.* Dr. Wray, Dr. Cash.

This course provides a broad overview of health and health care problems in developing countries. Central issues include analysis of the special health problems facing developing countries and of the organizational alternatives for utilizing health resources; the nature, composition, and training of the health team for use at the local and district levels; and the relation of health to development and the position of health in national planning priorities.

Preference is given to students who have previously been involved in international health activities.

Interdepartmental 212c. Biomedical Writing

Seminars. *One 2-hour session each week. 2 units.* Dr. Chernin.

Writing scientific papers is an integral part of the research process. This

course develops practical skills and experience in planning and writing articles that meet the editorial demands of biomedical journals. The salient elements of a well-prepared article — logical organization, clear and concise scientific prose, and understandable tables and figures — are emphasized by criticizing short papers written by the participants on biomedical subjects of their own choice.

Enrollment is limited to 10 students, with advance approval of the instructor.

Interdepartmental 215c,d. Environmental Health Evaluation and Management

Seminars, lectures. *Two 1½-hour sessions each week; additional computational sessions to be arranged. 5 units.* Dr. Harrington.

This course introduces concepts and analytical methods for the quantitative evaluation and management of man's environment. Topics discussed include the development of natural resources, resulting environmental conditions, and effects on human health. Where appropriate, mathematical models are developed and critiqued in a systems analysis framework. Students are required to submit a term project.

A strong background in college-level mathematics is assumed.

Interdepartmental 216c,d. A Social History of Disease and Health in America from the Revolution to World War II (Social Sciences 114)

Lectures, discussions. *Two 1-hour sessions each week; additional 1-hour discussion session to be arranged for students in the Medical Area. 5 units.* Dr. Rosenkrantz.

This course analyzes the changing definition of disease and health based on the study of American experience and expectation. The influence of demographic and epidemiologic events on health and the perception of health is discussed. The course includes a historical analysis of such topics as the origins of contagionist and anticontagionist viewpoints; responses to epidemics of the nineteenth and twentieth centuries; and the locus of authority for medical practice.

The following course, offered in the Faculty of Arts and Sciences, is open to properly qualified students from the School of Public Health.

History of Science 245c. Seminar: A History of Public Health

Half course (*fall term*). *W., 2-4.* Rosenkrantz.

Topic for 1978: A comparison of the social and scientific context in which personal hygiene and public health were distinguished in the United States and England, 1800-1950.

DEPARTMENT OF BEHAVIORAL SCIENCES

Department chairman to be announced.

Faculty: Visiting Professor Mertens; Associate Professors R. Benfari, McAuliffe, and J. Murphy; Lecturer Wechsler

Teaching and Research Staff: Lecturers and Visiting Lecturers J. Barrett, Borus, Burns, Klerman, Rolde, and Simmons

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The Department of Behavioral Sciences has a primary concern with the effect of individual behavior on health and illness and of group behavior on the organization and management of health programs. Students have the opportunity to study psychiatric epidemiology, the role of cultural factors in health and disease, health and illness behavior, organizational behavior, and mental health services.

The teaching plan is geared both to the student who has a social science background and wishes to know more about mental health and illness, and to the student who has a clinical orientation and wishes to know more about the social, cultural, and psychological influences which shape the human community. The Department participates in the programs leading to the degrees of Master and Doctor of Public Health and Master and Doctor of Science. (A description of programs leading to the degrees of S.M. and S.D. in Behavioral Sciences may be found in the section entitled "Admission and Degree Requirements and Academic Programs.")

Behavioral Sciences 202a,b. Styles of Pathological Behavior: An Introduction to Public Health Psychiatry

Seminars. *One 3-hour session each week. 2.5 units each period.* Dr. Benfari, Dr. Rolde.

The "a" period focuses on individuals whose behavior is considered antisocial or dangerous by society (violence, delinquency, addiction, psychopathy, child abuse). The emphasis is on the avoidance of stereotypes. The "b" period presents a sociopsychological approach to abnormal psychology and an eclectic examination of concepts in mental illness, including the lifestyles of psychosis, retardation, neurosis, and depression.

The course is intended for students with a wide variety of backgrounds. Either period may be taken separately. (Note: Dr. Rolde is the principal instructor for this course.)

Health Services Administration and Behavioral Sciences 203a,b. Administration and Organization of Health Services

Lectures, discussions. *Two 1½-hour sessions each week. 2.5 units each period.* Dr. Benfari, Dr. Neuhauser.

(Course is described under Department of Health Services.)

Behavioral Sciences 204c,d. Psychiatric Epidemiology: Problems, Concepts, and Methods

Seminars. *One 3-hour session each week. 5 units.* Dr. Wechsler.

The aim of this course is to introduce students to the field of psychiatric epidemiology. The emphasis in the "c" period is on studies of major psychoses such as schizophrenia using data obtained from psychiatric treatment services and institutions. In the "d" period, emphasis is given to the assessment of mental health in total populations through field surveys.

Prerequisites: Epidemiology 201a, Biostatistics 101a,b, or permission of the instructor. Either period may be taken separately, although it is recommended that students take both periods.

Behavioral Sciences 205c. Social Indicators

Seminars. *One 2-hour session each week. 2.5 units.* Dr. Murphy.

Not given in 1978-79.

This seminar deals with various ways of conceptualizing and measuring social processes of relevance to public health, with particular reference to mental health and mental illness. This includes studies of community integration, social class, and poverty. In addition, attention is given to the family, anomie, social networks, cultural values, and behavior settings. The course is designed especially for students who plan to work in fields such as social psychiatry, medical anthropology, or medical sociology.

Enrollment is subject to the approval of the instructor.

Behavioral Sciences 206c,d. Mental Health in the Non-Western World

Lectures, seminars. *One 2-hour session each week. 5 units.* Dr. Murphy.

Not given in 1978-79.

This course surveys mental and emotional problems in non-Western areas. Topics include cultural relativity in definitions, epidemiological findings, and the role of stress through cultural change, poverty, community disintegration, etc. Indigenous treatments and modern services for the mentally ill are discussed.

Enrollment is subject to the approval of the instructor.

Behavioral Sciences 207a,b. Personality Assessment in Field Surveys

Seminars. *One 2-hour session each week. 5 units.* Staff of the Department.

Not given in 1978-79.

This course familiarizes the student with various data-gathering techniques, such as clinical interviews, structured questionnaires, peer judgments, and standardized observations used in studying mental health and illness in populations. One segment of the course deals with the conceptualization and measurement of positive adaptation; another deals with assessing mental health of children.

Enrollment is subject to the approval of the instructor.

Behavioral Sciences 208a,b. Sociology of Addiction

Seminars, discussions. *Two 1½-hour sessions each week. 5 units.* Dr. McAuliffe.

Through lectures and discussions, the course covers the following topics: epidemiology, diffusion of drug use among peer groups, public policy, strategies of treatment and prevention, drug effects on maternal and child health, program planning and administration, deviant careers of addicts, social control, and community responses to sociomedical problems.

Behavioral Sciences 209c,d. Evaluation of Mental Health Services

Seminars. *One 1½-hour session each week. 2.5 units.* Dr. Haggerty, Dr. Borus, Dr. Simmons, Dr. Burns.

This course explores the theory and practice of evaluation research studies of mental health services and programs. The first section examines reasons for mental health evaluation, research designs, outcome measures, and problematic issues in implementation. The second section focuses on evaluations of specific mental health policies and interventions. The final section is a discussion of issues and practicalities of evaluating programs and delivery systems, using case examples.

(Note: Dr. Borus is the principal instructor for this course.)

Behavioral Sciences 210d. Inducing Social Change

Seminars. *Two 1½-hour sessions each week. 2.5 units.* Dr. Mertens.

This course is designed for various specialists in public health who are charged with responsibility for introducing changes in organizations and communities. The subject matter includes methods and theories of teaching, principles of individual and group psychotherapy, approaches to sensitivity training and group dynamics, and organizational theory. Techniques and procedures illustrating these theories are presented through readings, discussions, and case illustrations.

Behavioral Sciences 211d. Psychiatric Problems in Organizations and Industry

Lectures, readings, case illustrations. *One 2-hour session each week. 2.5 units.* Dr. Mertens.

The course is designed to provide basic information relevant to clinical and case management in industrial and other organizational settings. It analyzes research and clinical findings in such a way as to prepare students to handle not only individual maladaptation, but also disintegration at the organizational level. It presents successively etiology and symptomatology of individual and group dysfunction and is designed for students who already have a basic knowledge of psychopathology.

Enrollment is subject to the approval of the instructor.

Behavioral Sciences 213c,d. Managing Human Resources in Health Care Settings

Lectures, discussions. *One 3-hour session each week. 5 units.* Dr. Benfari.

Drawing heavily upon the applied behavioral sciences, this course is designed to provide future planners and managers in health care settings with knowledge and skills in designing and structuring organizations; planning and goal setting in complex environments; clarifying and allocating role responsibilities; making effective decisions; improving the effectiveness of teams; managing interprofessional conflicts; and managing the process of change.

Behavioral Sciences 215c,d. Methods of Social Research (Sociology 210)

Lectures, discussions. *Three 1-hour sessions each week. 5 units.* Dr. McAuliffe.

Not given in 1978-79.

Social research methods, including participant observation, social experiments, and surveys, are examined with respect to design, measurement, and sampling. Topics are discussed at an advanced level appropriate for doctoral students or master's degree students specializing in methodology.

Prerequisite: Statistics through multiple regression and factorial analysis of variance is assumed.

Behavioral Sciences 216a,b. Change of Health Behaviors

Lectures, laboratories. *Two 2-hour sessions each week. 5 units.* Dr. McAlister.

This seminar-practicum is designed to provide graduate and advanced undergraduate students with practical research and service experience in health promotion. Content includes theories of behavior change and communication, as well as analysis of specific programs. Each student is assigned to a specific problem area for discussion and field work.

Prerequisites: Previous course work in social/behavioral sciences or relevant experience, and permission of the instructor. Enrollment is limited to 10 students.

Behavioral Sciences 300a,b,c,d,e. Tutorial Programs

Time and credit to be arranged. Staff of the Department.

Arrangements can be made for a reading course in selected topics or practical experience in research.

Behavioral Sciences 330e. Field Study

A limited number of openings exist for research experience in the Department's field stations. These opportunities vary in nature from time to

time according to the stages of various research projects. Individual arrangements can be made through the Head of the Department.

Behavioral Sciences 350. Research Training

Training in research is available to doctoral candidates through individual arrangements with the staff of the Department. Topics offered include "Public Health Research in Community Settings" (Dr. Wechsler).

DEPARTMENT OF BIOSTATISTICS

C. Frederick Mosteller, S.B., S.M., Ph.D., S.D. (hon.), Professor of Mathematical Statistics and Head of the Department

Faculty: Professors and Visiting Professors Bailar, Miettinen, Reed, and Zelen; Associate Professors Bishop and Drolette; Assistant Professors Begg, Costello, Fuhrer, Gelber, Hanley, Lagakos, Laird, Lavin, MacIntyre, Mietlowski, Schoenfeld, Stanley, Thibodeau, and Waternaux; Lecturers Jones and Kent

Teaching and Research Staff: Lecturers and Visiting Lecturers Bauer, Frazier, Neff, and Wyshak

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The teaching aims of the Department of Biostatistics may be divided very generally into three categories:

First, it is essential for workers in all branches of public health to be able to draw justified conclusions from numerical data and to base logical action on these conclusions. This applies to the administrator who must evaluate problems and the results of his activities, as well as to the epidemiologist and the research worker who must apply statistical techniques to their laboratory and field problems. The course Biostatistics 101a,b is therefore designed to give not only a minimum command of simple methodology to all students but an appreciation of the value of the method and an awareness of the frequent abuse encountered in the health literature.

Second, field and laboratory researchers must be able to use statistical methods in planning and analyzing their experiments and problems. Some elective courses are designed to provide an introduction to methodology in this area. These courses are adapted to the needs of students of this School, many of whom have broad backgrounds in biological sciences while few have extensive preparation in mathematics. A minimum of mathematical exposition is therefore included in some courses intended for students in these categories. Other electives go into more depth in particular topics. In all electives the emphasis is on understanding the underlying assumptions inherent in standard statistical procedures and on the ability to determine when such procedures are appropriate.

Third, there is a smaller group of students particularly interested in graduate work in biostatistics. To meet the needs of these students, the Department offers programs leading to the degrees of Master and Doctor of Science in Biostatistics. A description of these programs may be found in the section entitled "Admission and Degree Requirements and Academic Programs."

Any course in the Department is open to any student who meets the prerequisites stated in the course description.

Biostatistics 101a,b. Principles of Biostatistics

Lectures. *Two 1-hour sessions each week.*

Laboratory. *One 3-hour session each week. 5 units.* Dr. Drolette.

Lectures and laboratory exercises acquaint the student with the basic concepts of biostatistics, their application and interpretation. Topics include descriptive statistics, probability distributions, inference, tests of significance, association, and regression. Laboratory groups will be organized by areas of academic interest or specialization.

Biostatistics 202c,d. Statistical Methods in Research

Lectures, discussions, laboratory. *Two 3-hour sessions each week. 5 units.* Dr. Waternaux.

This course, a continuation of Biostatistics 101a,b, introduces the student to technical statistical procedures important in problems of laboratory and field research. Topics included are further considerations of probability and chi-square techniques, together with an introduction to procedures used in the planning of experiments, including variance analysis, nonparametric methods, dosage response, and regression.

Prerequisite: Basic preparation in statistics.

Epidemiology and Biostatistics 203b. Principles of Epidemiologic Research I: Problem Conceptualization and Study Design

Lectures, seminars. *Two 2-hour sessions each week. 4 units.* Dr. Miettinen.

(Course is described under Department of Epidemiology.)

Epidemiology and Biostatistics 203c. Principles of Epidemiologic Research II: Data Analysis and Inference

Lectures, laboratory. *Two 2-hour sessions each week. 3 units.* Dr. Miettinen.

(Course is described under Department of Epidemiology.)

Epidemiology and Biostatistics 204c,d. Principles of Epidemiologic Research III: Applications

Tutorials, seminars. *Tutorial sessions during third period; one 2-hour seminar each week during fourth period. 2.5 units.* Dr. Rothman.

(Course is described under Department of Epidemiology.)

Biostatistics 205c,d. Mathematical Foundations of Biostatistics

Lectures. *One 2-hour session each week. 2.5 units.* Dr. Drolette.

The material covered includes mathematical descriptions of commonly used distributions, standard procedures for estimating the moments of a distribution, and mathematical foundations of statistical inference, including the Neyman-Pearson lemma, the likelihood ratio, the central limit theorem, power and Bayesian inference.

Prerequisite: A course in elementary calculus.

Biostatistics 207c,d. Survey Research Methods in Community Health

Lectures, discussions. *One 2-hour session each week. 2.5 units.* (Instructor to be announced).

Research design, sample selection, questionnaire construction, interviewing techniques, the reduction and interpretation of data, and related facets of population survey investigations are covered. The course is focused primarily on the application of survey methods to problems of health program planning and evaluation. The treatment of methodology is sufficiently broad to be suitable for students who are concerned with epidemiological, nutritional, or other types of survey research.

Biostatistics and Health Services Administration 208c,d. Health Program Evaluation (formerly Biostatistics and Health Services Administration 216c,d)

Lectures, discussions. *One 2-hour session each week. 4 units.* Dr. Fuhrer, Dr. Waternaux.

This course is designed to increase the student's ability to understand the uses and limitations of methods employed to evaluate health programs. The course provides an overview of the purposes and procedures of evaluation methods as applied to health programs. The course is sufficiently broad to be of interest to program administrators and to health program analysts.

Biostatistics 210. Advanced Topics in Biostatistics

Lectures, discussions. *One 2-hour session each week. 2.5 units per semester.* (Instructor to be announced).

This course is offered primarily for students majoring in biostatistics or epidemiology, though other qualified students are welcome. It may be offered in the first semester ("a" and "b" periods), in the second semester ("c" and "d" periods), or in both. Topics and instructors will be announced.

Biostatistics 211c,d. Discrete Multivariate Analysis

Lectures, discussions. *One 2-hour session each week. 5 units.* Dr. Bishop.

This course deals with the use of log-linear models for describing multidimensional contingency tables. Emphasis is on practical application rather than mathematical theory. Topics covered include use of such models for determining when tables can be reduced in size without changing the relationships between variables, hypothesis testing, obtaining rates standardized for more than one underlying variable, and combining data sets from different sources.

Prerequisite: A statistics course which includes analysis of variance.

Biostatistics 213b. Computing Principles and Methods

Lectures, discussions, laboratory. *Two 2-hour sessions each week. 2.5*

units. Dr. Costello, Dr. Neff, Staff of the Health Sciences Computing Facility.

Among the principles and methods of computing and data processing included in the course are programming, flow-charting, and the use of a statistical program package, a data base management system, and computer program libraries. Criteria for choosing among existing programs are delineated. Case studies are used to illustrate methods of data collection, coding, and data reduction.

Enrollment is subject to the approval of the instructor.

Biostatistics 220c,d. Multivariate Analysis for Quantitative Data

Lectures, student presentations. *Two 1½-hour sessions each week. 5 units.* Staff of the Department.

Topics covered include multiple regression, principal component and factor analysis, discriminant functions, clustering, and canonical correlation, with some discussion of distribution theory and tests of hypotheses. Students will participate in the analysis of a data set.

Prerequisites: At least one statistics course beyond the level of Biostatistics 101a,b, knowledge of matrices, and, if possible, some familiarity with computer programs such as SPSS.

Biostatistics 240c,d. Design of Experiments (Statistics 140)

Lectures. *Two 1½-hour sessions each week. 5 units.* Dr. Laird.

Not given in 1978-79; to be given in 1979-80.

This course examines general principles and practical difficulties in controlled experimentation. Topics covered include an introduction to randomization theory, methods for increasing precision, principal types of designs, mixed and random effects models, and variance component estimation. The course is intended both for students with a primary interest in statistics and biostatistics and for students in the experimental sciences.

Prerequisites: One or more courses covering the basic concepts of distributions, expectations, samples, testing, estimation, regression, and analysis of variance.

Health Services Administration and Biostatistics 241a,b. Statistical Methods for Health Policy and Management (formerly Interdepartmental 214a,b)

Lectures. *Two 1½-hour sessions each week. 5 units.* Dr. Thibodeau.

(Course is described under Department of Health Services.)

Health Services Administration and Biostatistics 241c,d. Quantitative Methods for Health Policy and Management (formerly Interdepartmental 214c,d)

Lectures, discussions. *Two 1½-hour sessions each week. 5 units.* Dr. Thompson, Dr. Sahney.

(Course is described under Department of Health Services.)

Health Services Administration and Biostatistics 243c. Analysis of Health and Medical Practices (formerly Health Services Administration and Biostatistics 290c) (Public Policy 290)

Lectures, discussions. *Two 1-hour sessions each week. 2.5 units.* Dr. Milton C. Weinstein (Associate Professor of Public Policy, John F. Kennedy School of Government).

(Course is described under Department of Health Services.)

Biostatistics 251a,b. Data Analysis

Lectures, discussions. *Two 2-hour sessions each week. 5 units.* Dr. Zelen, Staff of the Department.

This course consists of examples and case studies of applications of statistics to the biomedical sciences. Five major units consist of topics drawn from distribution-free methods, discrete data analysis, parametric procedures, least squares, and critiquing the biomedical literature. One- and two-sample problems, techniques of fitting straight lines, short-cut procedures, and the summarizing and reporting of data are included.

Prerequisite: A course in statistics or permission of the instructor.

Biostatistics 261a,b. Theory of Biometry I

Lectures. *Two 1½-hour sessions each week. 5 units.* Dr. Zelen, Staff of the Department.

Not given in 1978-79; to be given in 1979-80.

This course discusses the theoretical basis of concepts and methodologies associated with bioassay, life tables, the general theory of survival distributions and censoring, competing risk models, and the planning of clinical trials. Material is drawn from the recent literature.

Prerequisite: Statistics 111 or equivalent, or permission of the instructor.

Biostatistics 262c,d. Theory of Biometry II

Lectures, discussions. *Two 1½-hour sessions each week. 5 units.* Dr. Zelen, Staff of the Department.

Not given in 1978-79; to be given in 1979-80.

This course is a continuation of Biostatistics 261a,b. Topics include semi-Markov processes as models for disease processes; generalizations of the stable disease model, such as incidence, prevalence, and time in state; models of early detection of disease; length-biased sampling; optimization and periodic screening; and cell kinetics and labeling techniques.

Prerequisite: Biostatistics 261a,b.

Biostatistics 263a,b. Regression and Analysis of Variance

Lectures. *Three 1-hour sessions each week. 5 units.* Dr. Begg.

This course examines the methods of least squares and maximum likelihood as applied to linear statistical models: multivariate regression, calibration, analysis of variance, and random effects models. Topics include the development of hypothesis testing, confidence intervals and Bayesian techniques. Exercises and examples emphasize medical applications.

Prerequisites: A course in statistics at the level of Statistics 110 or 190; familiarity with matrix algebra.

Biostatistics 266c,d. Stochastic Processes in Medicine and Biology

Lectures, discussions. *Two 1½-hour sessions each week. 5 units.* Dr. Zelen, Dr. Lagakos.

This course discusses those areas of modern applied probability useful for model building in the biomedical sciences. Topics include Poisson processes, birth and death processes, Markov chains and processes, renewal theory, compartment models, random walks and sequential analysis, and the theory of epidemics. Examples are drawn from the biomedical sciences.

Prerequisite: Statistics 111 or equivalent, or permission of the instructor.

Biostatistics 271. Computer Programming

Lectures. *Two 2-hour sessions each week for the first two weeks of the "a" period.*

Laboratory. *10 hours each week for the first two weeks of the "a" period.*

No credit is given for this course. Staff of the Department.

This is an intensive, non-credit short course in computer programming in the FORTRAN language. Students without previous exposure to this language develop a working proficiency in it. The course provides minimal skills in computer programming necessary to enter subsequent computing courses in the Biostatistics curriculum.

Biostatistics 273a,b. Introduction to Computing

Lectures. *Two 1½-hour sessions each week.*

Laboratory. *One 2-hour session each week. 5 units.* Dr. Costello, Dr. Neff.

This course introduces the fundamentals of computing, emphasizing algorithms, information flow, and the systematic design of programs in higher-level languages such as FORTRAN. Topics include the structure of digital computers, programming languages, algorithm development and usage, systems of analysis, and systematic design of programs and computing systems.

Prerequisite: Previous programming experience, or Biostatistics 271 taken concurrently.

Biostatistics 274c,d. Statistical Computing

Lectures. *Two 1½-hour sessions each week.*

Laboratory. *One 1½-hour session each week. 5 units.* Staff of the Department.

This course enables students to understand, properly use, and possibly develop, statistical algorithms or software. Topics are motivated by statistical procedures or biomedical applications, and include computer arithmetic, error analysis, numerical techniques, equation solving, matrix operations, approximation and smoothing, optimization, and simulation modeling.

Prerequisite: Biostatistics 273a,b or equivalent, or permission of the instructor.

Biostatistics 275a,b. Applied Data Management

Lectures, demonstrations. *Two 1½-hour sessions each week.*

Laboratory. *One 1½-hour session each week. 5 units.* Staff of the Department.

Not given in 1978-79; to be given in 1979-80.

This course introduces management of data, both external and internal to computer data bases, concepts and techniques for handling data before it is ready for analysis, and practical aspects of computer data base design and usage. Topics include data collection, forms and coding, data entry systems, quality control, data base structures (both logical and physical), data base management systems, file organization, and data models.

Prerequisite: Biostatistics 274c,d or equivalent, or permission of the instructor.

Biostatistics 310-315a,b,c,d. Tutorial Programs

Time and credit to be arranged. Staff of the Department.

An opportunity for tutorial work at the master's level is offered for interested and qualified students or small groups of students. Arrangements must be made with individual faculty members and are limited by the amount of faculty time available. These tutorial programs are open to students specializing in biostatistics and also to students in other fields who wish to go beyond the content of the regular courses. Six broad categories of this tutorial instruction are identified by the six course numbers below.

310 *Tutorial in Statistical Methods*
Guided study in specific areas of statistical methodology and application.

311 *Tutorial in Teaching*
Work with the Department in laboratory instruction and the development of teaching materials.

312 *Tutorial in Consultation*
Work with members of the Department on current statistical consultation activities.

313 *Tutorial in Computing*
Guided study in scientific programming, numerical methods, and data management.

314 *Tutorial in Study Design*
Guidance in developing statistical design of a study in which the student has a particular interest.

315 *Tutorial in Data Analysis*
Guidance in the statistical analysis of a body of data in which the student is interested.

Students may register for Biostatistics 310-315 for a maximum of ten credit units in the summer term.

Biostatistics 350. Research
Candidates for the Doctor of Public Health, Doctor of Science, or other doctoral degrees may arrange for individual research. The work may be part of the program for a doctorate in this Department or may be integrated with doctoral research in other departments.

ENVIRONMENTAL HEALTH INTERDEPARTMENTAL COURSES

The following courses are conducted by the faculty and staff of the Kresge Center for Environmental Health, which includes the Departments of Environmental Health Sciences, Physiology, and Sanitary Engineering.

Environmental Health Interdepartmental 201a,201b. Principles of Environmental Health

Lectures, discussions. *Two 1-hour sessions and one 2-hour session each week. 2.5 units each period.* Dr. Moeller, Staff of the Kresge Center.

This course reviews the more important environmental health problems facing society. Topics in the "a" period include environmental radiation control, community air pollution, occupational health, and selected physical stresses. Topics in the "b" period include basic sanitation, water purification, traumatic injuries, environmental law and economics, environmental toxicology, land use planning, and environmental health implications of energy use. Either period may be taken separately.

Environmental Health Interdepartmental 204c,d. Human Factors in Occupational Performance and Safety

Lectures, demonstrations. *One 2-hour session each week. 2 units.* Dr. Snook.

This course emphasizes the design of the job to fit the worker. Specific problems are investigated which result from the nature of the job itself, e.g., low back injuries, fatigue, hand disorders, slips and falls, human error, and psychological stress. The physiological, psychological, and anatomical characteristics of the worker are considered in the development of good job design principles.

Environmental Health Interdepartmental 205a,b. Current Topics in Occupational Health and Safety

Seminars. *One 1-hour session each week. 1 unit.* Dr. Peters, Staff of the Kresge Center, and Visiting Lecturers.

Weekly seminars are presented by faculty or guests involved with occupational health and safety problems. The purpose of the course is to introduce students concentrating in occupational safety and health (including industrial hygiene) to the field. The seminars cover technical as well as policy issues.

(Note: This course may only be taken pass/fail.)

Environmental Health Interdepartmental 206a,b. Occupational Medical Clinics

Lectures, clinics. *One 2-hour session each week. 2 units.* Dr. Fine, Dr. Murphy.

The course reviews the diagnostic techniques used by clinicians to detect and screen for a variety of occupational diseases, such as silicosis, contact dermatitis, and lead poisoning. The clinical syndromes of common occupational diseases are considered. The clinics are limited to physicians.

Enrollment is subject to the approval of the instructor.

Environmental Health Interdepartmental 207c,d. Policy Issues in Occupational Health

Seminars. *One 2-hour and one 1½-hour session each week. 5 units.* Dr. Boden.

This course examines the legal, economic, and political foundations of occupational health activities in the United States. It enables students to develop the knowledge and skills in the above areas necessary to apply medical, industrial hygiene, and statistical skills to achieve a healthful workplace. The role of government, unions, corporations, and research organizations is discussed.

Environmental Health Interdepartmental 209c,d. Mathematical Modeling for Health Sciences

Lectures, discussions. *Three 1-hour sessions each week, third period; two 2-hour sessions each week, fourth period. 4 units.* Dr. Butler.

A range of models for the space and time dependence of the key variables in natural systems is discussed. Specific applications emphasize processes that characterize the response of the organism to its environment. The inverse problem of using measurements to infer estimates of parameters of models is developed.

Prerequisites: Calculus, Physiology 203a,b, and statistics to the level of concurrent enrollment in Biostatistics 202c,d, 205c,d, or 210c,d.

Environmental Health Interdepartmental 211a,b. Critical Review of the Scientific Basis for Occupational Standards

Seminars. *One 2-hour session each week. 2.5 units.* Dr. Wegman, Dr. Peters.

This course is designed to provide students with the opportunity to review the scientific basis for the association of selected occupational exposures with disease. Special emphasis is placed on critical evaluations of the literature. The course also reviews occupational cancer and respiratory disease, pathophysiology of respiratory disease and epidemiologic approaches to chemical carcinogenesis.

Prerequisites: Epidemiology 201a, Biostatistics 101a,b, Environmental Health Interdepartmental 251c,d, and permission of the instructors.

Environmental Health Interdepartmental 251c,d. Basic Problems in Occupational Health and Industrial Environments (Engineering 282)

Lectures. *Two 2-hour sessions each week.*

Laboratory demonstrations, field trips. *One 3-hour session each week. 5 units.* Dr. Ferris, Dr. Peters, Mr. Burgess, Dr. Smith.

Lectures, laboratory demonstrations, and inspections of workplaces show the relation of working conditions to health, with special reference to the recognition, measurement, and control of hazards. Examples include adverse conditions of temperature, humidity, radiation, and chemical and physical irritants. Particular emphasis is given to the prevention, diagnosis, and treatment of industrial disability and disease, and to workmen's compensation.

Prerequisite: Physiology 203a,b.

Environmental Health Interdepartmental 330e. Field Work

One-week period between fall and spring terms. 1 unit.

A week of supervised field observation is offered during the one-week period between fall and spring terms. Students may choose appropriate visits to medical or industrial hygiene departments of industries, airports, and other agencies which have operations or research in the field of environmental health.

DEPARTMENT OF ENVIRONMENTAL HEALTH SCIENCES

Dade W. Moeller, S.B., S.M., Ph.D., A.M. (hon.), Professor of Engineering in Environmental Health, Head of the Department, and Associate Director, Kresge Center for Environmental Health

Faculty: Professor First; Associate Professors Burgess and Dennis; Assistant Professors Cooper, Hinds, D. H. Leith, Smith, and Spengler; Lecturers Bjarngard, Cudworth, Judy, Shapiro, and Webster

Teaching and Research Staff: Lecturers and Visiting Lecturers Anderson, J. M. Austin, Billings, Bracken, Mahoney, Nelson, Selby, Svensson, Viles, and Zimmerman; Research Associates Grubner, Underhill, and Wolfson

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Because of growing public awareness of the need for environmental pollution control and worker protection, increasing attention is being focused on these problems at all levels of our society. Research and training have been conducted on these major subjects at the Harvard School of Public Health since 1918. Applicable curricula offered by the Department of Environmental Health Sciences include air pollution control, environmental health management, industrial hygiene, medical radiological physics, and radiological health. In addition to specialized courses, graduate education in each of these fields includes courses on human physiology, epidemiology, and biostatistics. Programs of the Department are open to engineers, physicians, and other professional personnel with undergraduate backgrounds in physics, chemistry, mathematics, and biology. (For a description of the Master and Doctor of Science programs offered by the Department, see the section entitled "Admission and Degree Requirements and Academic Programs.")

Supporting the teaching program are extensive research activities. Current studies include the evaluation of the exposure of workers to air contaminants, assessment of the environmental impact of nuclear facilities, medical radiation applications and dosimetry, the design of cleanup systems for radioactive sodium aerosols, the application of gas- and liquid-phase reactions to particulate and gas removal, a numerical study of urban scale atmospheric transport, the monitoring of worker stresses by telemetered physiological measurements, and an investigation of the population dose from radiation of natural origin. Supporting these studies are related cooperative research projects conducted by the Departments of Physiology and Epidemiology. As a result, students have many excellent opportunities for research, either on an independent basis or as a participant in an ongoing project.

As may be noted, some of the courses in this Department carry "Engineering" numbers. These are cross-listed in the catalog of the Division of Applied Sciences in Cambridge and provide course credit through that Division as well as through the School of Public Health.

Environmental Health Sciences 202a, 202b, 202c, 202d. Departmental Seminars

Seminars. *One 2-hour session each week. First and third periods: 1 unit each. Second and fourth periods: 1.5 units each.* Dr. Cooper, Dr. Spengler, Staff of the Department.

These seminars supplement formal course work in the Department of Environmental Health Sciences. Each period has a somewhat different focus: a. historical development of the environmental health sciences; b. current issues in environmental health; c. review of ongoing departmental research; and d. environmental simulations, models, and gaming.

Environmental Health Sciences 211a,b. Introduction to Environmental Health Management

Lectures, seminars. *Two 2-hour sessions each week. 5 units.* Dr. Cooper.

This course focuses on quantitative and descriptive methods that can aid in decision making relative to environmental health management. Techniques such as forecasting, modeling, cost/benefit analysis, optimization, and quality control are reviewed in terms of their application to the determination and implementation of environmental policies. Guest speakers provide further examples of models and mathematical analyses applied to specific problems.

Environmental Health Sciences 252a,252b. Environmental Control (Engineering 280)

Lectures. *Two 1-hour sessions each week.*

Laboratory. *One 3-hour session each week. 2.5 units each period.* Mr. Burgess, Dr. Cudworth.

The first half of this course centers on the design and evaluation of industrial ventilation systems for the control of toxic contaminants released into the workplace through industrial operations and processes. The second half is designed for environmental health specialists responsible for evaluation and control of noise hazards. Topics include measurements and instrumentation, and specific control approaches for production equipment.

Environmental Health Sciences 253a,b. Aerosol Technology (Engineering 286)

Lectures. *Two 1-hour sessions each week.*

Laboratory. *One 2-hour session each week, first period; one 4-hour session each week, second period. 5 units.* Dr. Hinds.

This course covers the properties of suspended particulate matter (dust, smoke, clouds) and the physical principles underlying its behavior. Topics covered include: particle motion due to gravitational, thermal, and elec-

trostatic forces; diffusion; impaction; coagulation; filtration; condensation and evaporation; optical properties; and sizing statistics. Laboratories cover optical and electron microscopy, sampling, and mass concentration and particle size measurement.

Environmental Health Sciences 261a,b. Community Air Pollution (Engineering 284)

Lectures, seminars. *Two 2-hour sessions each week. 5 units.* Dr. First, Dr. Leith.

This course is designed for engineers, chemists, and physicians interested in air pollution control. Topics include the measurement and control of community air pollution; pollutant dispersion; air quality standards; health effects; damage to animals, plants, and property; community and site surveys; the legal and enforcement aspects of air pollution control; the nature and quantity of atmospheric emissions from vehicles, incinerators, and specific industries.

Environmental Health Sciences 262c,d. Meteorological Aspects of Air Pollution (Engineering 285)

Lectures. *Two 2-hour sessions each week. 5 units.* Dr. Spengler.

This course presents an evaluation of the meteorological factors associated with the transport, transformation, dispersion, and removal of air pollutants. Topics include general circulation, physical meteorology, weather forecasting, turbulent dispersion, diffusion equations, diffusion models for point, area, line, and urban sources, and instrumentation for evaluating the movement and behavior of air pollutants.

Prerequisite: Environmental Health Sciences 261a,b.

Environmental Health Sciences 264c,d. Identification and Measurement of Air Contaminants (Engineering 283)

Lectures. *Two 1-hour sessions each week.*

Laboratory. *One 3-hour session each week. 5 units.* Dr. Smith, Staff of the Department.

This course emphasizes sampling and analytical methods for air contaminants plus related subjects. Included are chemical and instrumental methods of air analysis, isokinetic sampling, biological and solvent analysis, radioactive aerosol determinations, air pollution surveys, and fire and explosion evaluations. The course is recommended for concentrators in industrial hygiene and air pollution control and suggested for students in the radiological health and M.I.H. programs.

Environmental Health Sciences 265c,d. Air and Gas Cleaning

Lectures. *One 2-hour session each week.*

Laboratory. *One 2-hour session each week. 5 units.* Dr. First, Dr. Leith, Staff of the Department.

This course covers theory, selection, application, and testing of air and gas cleaning devices, including gas absorption in liquids and adsorption on solids, gas incineration, particle collection by inertial and centrifugal force, and basic processes of particle conditioning. Laboratory experiments and case studies illustrate important aspects of sizing and correct selection of equipment.

Prerequisites: Environmental Health Sciences 253a,b and 264c,d (may be taken simultaneously).

Environmental Health Sciences 271a,b. Introduction to Radiation Protection (Engineering 288)

Lectures, demonstrations. *One 2-hour and one 1-hour session each week. 5 units.* Dr. Shapiro, Dr. Moeller.

This course covers laboratory, industrial, and environmental sources of radiation; the interaction of ionizing particles with matter; the concept of radiation dose from external and internal sources; radiation measurements; radiation protection standards and regulations; and methods of environmental and occupational radiation protection. (Students desiring laboratory experience in the use of radiation measuring instruments should enroll concurrently in Environmental Health Sciences 272b.)

Environmental Health Sciences 272b. Introduction to Radiation Instrumentation

Laboratory. *One 2-hour session each week. 1.25 units.* Dr. Shapiro.

This laboratory provides an introduction to the use of radiation measuring equipment and supplements the material provided in Environmental Health Sciences 271a,b. Exercises cover radiation counting, gamma spectroscopy, and the use and calibration of radiation survey instruments. (This course is available to students in Environmental Health Sciences 271a,b who desire laboratory experience in the use of radiation measuring instruments.)

Prerequisites: Previous or concurrent enrollment in Environmental Health Sciences 271a,b, and permission of the instructor.

Environmental Health Sciences 273c,d. Advanced Topics in Radiation Protection (formerly Environmental Health Sciences 272d)

Lectures, discussions. *One 2-hour session each week. 2.5 units.* Dr. Shapiro, Dr. Moeller.

This course involves detailed study of current handbooks and publications related to radiation protection. Areas covered include the regulation of radiation use and the evaluation and control of radiation hazards. Specific topics include regulatory guides and standards, radiation shielding with emphasis on neutrons, protection against internal emitters, and the control of radioactive contamination.

Prerequisites: Environmental Health Sciences 271a,b and permission of the instructors.

Environmental Health Sciences 274c. X-ray Protection

Lectures. *One 2-hour and one 1-hour session each week.*
Laboratory. *One 3-hour session each week. Time to be arranged. 2.5 units.* Dr. Webster.

This course covers the fundamentals of X-ray equipment (both industrial and medical), the design of X-ray installations, and procedures for radiation protection surveys and inspections, and includes several problem assignments. Considerations include both equipment and room design, with emphasis on items such as leakage, collimation, filtration, primary and secondary barriers, workload, and protection of patients.

Prerequisite: Environmental Health Sciences 271a,b.

Environmental Health Sciences 281a. Introduction to Physics of Diagnostic Radiology.

Lectures. *Two 2-hour sessions each week. 2.5 units.* Dr. Philip Judy.
Given alternate years; to be given in 1979-80.

This course for students in medical physics and radiological health covers the fundamentals of diagnostic radiology, including diagnostic criteria, such as abnormal size, position, motion, or structure; principles of specific studies, e.g., cardiac angiography; and the use of contrast media. The course reviews principles of equipment employed, such as diagnostic X-ray sources, recording systems, film, screens and image intensifiers, and factors affecting image quality and patient exposure.

Environmental Health Sciences 282b. Introduction to Physics of Nuclear Medicine

Lectures. *Two 2-hour sessions each week. 2.5 units.* Dr. Bjarngard, Mr. Zimmerman.
Given alternate years; to be given in 1979-80.

Production and properties of radionuclides and radiopharmaceuticals, as well as the physiological basis for medical applications, form the foundation for this course for students in medical physics and radiological health. Principles of specific studies are presented (e.g., uptake measurements, tracer kinetics, static and dynamic imaging and *in vitro* techniques). Instrumentation and factors affecting accuracy, image quality, and patient exposure are also discussed.

(Note: Mr. Zimmerman is the principal instructor for this course.)

Environmental Health Sciences 283a. Introduction to Physics of Radiation Therapy

Lectures. *Two 2-hour sessions each week. 2.5 units.* Dr. Bjarngard, Dr. Svensson.
Given alternate years; to be given in 1978-79.

This course for students in medical physics reviews tumors of different

primary sites, including their histology and routes of spread. Various aspects of radiation therapy are discussed, including time-dose relationships, influence of oxygen and chemical agents, tumor localization, treatment planning, and simulation. Also covered are treatment with external beams, radioactive isotopes, implants and intercavitary sources; dose calculations; and machine design and specifications.

(Note: Dr. Svensson is the principal instructor for this course.)

Environmental Health Sciences 284c,d. Physics of Diagnostic Radiology

Lectures. *One 2-hour and one 1-hour session each week.*

Laboratory. *One 3-hour session each week. 5 units.* Dr. Webster.

Given alternate years; to be given in 1979-80.

This course deals with the physical and mathematical aspects of image formation, including characteristics of diagnostic X-ray machines and recording systems, geometrical relationships, X-ray spectra, information limits, optical physiology and performance, special techniques such as magnification and cine radiography, and computerized tomography. Radiation protection is also covered, with an emphasis on patient dose.

Environmental Health Sciences 285a,b. Physics of Nuclear Medicine

Lectures. *One 2-hour session each week.*

Laboratory. *One 3-hour session each week. 5 units.* Dr. Bjarngard, Mr. Zimmerman.

Given alternate years; to be given in 1978-79.

This course covers the physical and chemical aspects of production, properties and standardization of radionuclides and radiopharmaceuticals, including cyclotron production of short-lived isotopes. Also discussed are instrumentation (e.g., scanners, cameras, proportional counters, the positron camera) and computer applications involving dynamic and regional function analysis, radionuclide tomography, and image processing. The measurement of calcium in bone is also covered.

Environmental Health Sciences 286c,d. Physics of Radiation Therapy

Lectures. *One 2-hour session each week.*

Laboratory. *One 3-hour session each week. 5 units (2.5 units each period).* Dr. Bjarngard.

Given alternate years; to be given in 1978-79.

This course deals with the mathematics of treatment planning for external beams, brachytherapy and radioactive nuclides, including computerized techniques. Also covered are accurate and precise dosimetry measurements for photons, electrons, protons, and neutrons, including calibration and quality control of machines and sources. Selected studies of current clinical problems are also presented. Either period may be taken separately.

Environmental Health Sciences 301-306a,b,c,d,e. Tutorial Programs

Reading or research. *Time and credit to be arranged.*

Reading or research assignments for individual tutorial work at a master's degree level are provided for qualified students in the fields of industrial hygiene, industrial ventilation, aerosol technology, radiological health, medical radiation physics, nuclear medicine, solid waste management, air pollution control, and environmental health management.

301 *Air Pollution.* Dr. Cooper, Dr. First, Dr. Leith, Dr. Spengler.
302 *Industrial Hygiene.* Mr. Burgess, Dr. Hinds, Dr. Smith.
303 *Radiological Health.* Dr. Moeller, Dr. Shapiro.
304 *Medical Physics.* Dr. Bjarngard, Dr. Webster.
305 *Solid Wastes.* Dr. First.
306 *Environmental Health Management.* Dr. Cooper, Dr. Moeller.

Enrollment is subject to the approval of the Head of the Department.

Environmental Health Sciences 350-360. Research

Facilities of the Department are available for doctoral candidates and properly qualified second-year master's degree students to pursue independent research on problems in industrial hygiene, aerosol technology, solid waste management, air pollution control, and radiological health. Areas currently receiving study in the Department are as follows:

351 Evaluation of performance factors of respiratory protective devices; monitoring exposures of occupational groups to toxic air contaminants; ventilation control of airborne contaminants; evaluation and control of noise *(Dr. Smith).*

352 Application of gas- and liquid-phase reactions to particulate and gas removal; development and design of cleanup systems for airborne contaminants from industrial and nuclear power plant facilities; incineration of solid wastes including municipal, radioactive, biological, and laboratory materials *(Dr. First, Dr. Leith).*

353 Measuring and modeling the performance of industrial gas cleaning equipment; assessing the air pollution potential of simple and complex pollution sources *(Dr. Leith).*

354 Computer modeling of pollutant transport in urban atmospheres; analysis of air quality data derived from sampling networks; meteorology of urban areas *(Dr. Spengler).*

355 Experimental and theoretical research in aerosol generation, measurement, behavior, and control; quantitative methods of environmental management *(Dr. Cooper).*

356 Reduction of population dose from sources of natural origin; en-

vironmental protection for nuclear facilities; radiation safety criteria and standards *(Dr. Moeller).*

357 Sampling and analysis of aerosol particles both in the ambient atmosphere and under laboratory conditions; generation of monodisperse aerosols; uses of aerosols in environmental health; development of particulate removal equipment *(Dr. Hinds).*

358 Evaluation and control of hazards from radioactive contamination; radiation dosimetry *(Dr. Shapiro).*

359 Medical radiation physics with emphasis on dosimetry, nuclear medicine, and radiation therapy *(Dr. Bjarngard).*

360 Medical radiation physics with emphasis on survey techniques, instrumentation, and image quality and patient dose reduction in diagnostic radiology *(Dr. Webster).*

Enrollment is subject to the approval of the Head of the Department.

The following courses, offered in the Faculty of Arts and Sciences at Harvard and at the Massachusetts Institute of Technology, are open to properly qualified students from the School of Public Health and may be of special interest to students of environmental health sciences.

Economics 1010a,c. Microeconomic Theory
Half course *(fall term). M., W., (F.), at 11.* Bergson.

Economics 1011a. Microeconomic Theory and Policy Analysis
Half course *(spring term). M., W., F., at 11.* Kresge.

Economics 1551. The Political Economy of Environmental Quality
Half course *(spring term). M., W., F., at 11.* Dorfman.

Engineering 254. Mathematical Programming for Large Systems
Half course *(fall term). M., W., F., at 9.* Rogers.

Natural Sciences 110. Automatic Computing
Half course *(fall term). M., W., F., at 10.* Lewis.

Natural Sciences 115. Models for Control of Man's Physical Environment
Half course *(fall term). M., W., F., at 9.* Harrington, Rogers.

Natural Sciences 134. Technological Assessment
Half course *(spring term). Tu., Th., at 10.* Brooks.

Natural Sciences 145. Energy, the Environment, and Public Policy
Half course *(fall term). M., W., F., at 1.* Wilson.

Public Policy 211. Analysis for Decision Making
Half course *(fall term). Tu., Th., 4-5:30.* Stokey, Raiffa.

Public Policy 215. Seminar: Mechanisms for Promoting Environmental Quality
Half course *(throughout the year). Hours to be arranged.* Capron, Schelling, Zeckhauser.

Public Policy 233. Program Evaluation and Policy
Hours to be arranged. Thompson.

Public Policy 271a. Law and Public Policy: Policy Analysis
Half course *(fall term). M., W., 4-5:30.* Roberts, Schelling.

Public Policy 282a,b. Science, Technology, and Public Policy
Half course *(fall and spring terms). M., 2-4.* Staff.

M.I.T. 1.143. Mathematical Optimization Techniques
Nine units. *Fall term, Tu., Th., 2:30-4.* Staff.

M.I.T. 1.146. Engineering Systems Analysis
Nine units. *Fall term, Tu., Th., 10:30-12.* DeNeufville *et al.*

M.I.T. 1.811. Environmental Law: Pollution Control
Nine units. *Fall term, hours to be arranged.* Staff.

M.I.T. 1.812. Environmental Law: Land Use and the Siting of Facilities
Nine units. *Spring term, hours to be arranged.* Staff.

M.I.T. 14.121. Microeconomic Theory
Six units. *Fall term, M., W., 1:30-3 (first half term only).* Bishop.

M.I.T. 15.065. Decision Analysis
Nine units. *Fall and spring terms, Tu., Th., 10:30-12.* Kaufman.

M.I.T. 15.081. Mathematical Programming
Twelve units. *Fall and spring terms, Tu., Th., 2-3:30.* Magnanti.

M.I.T. 22.37. Environmental Impact of Power Production
Twelve units. *Fall term, Tu., Th., 1:30-3.* Golay.

DEPARTMENT OF EPIDEMIOLOGY

Brian MacMahon, M.B., Ch.B., D.P.H., Ph.D., S.M. in Hyg., M.D., Henry Pickering Walcott Professor of Epidemiology and Head of the Department

Faculty: Professors Cole, Hutchison, Miettinen, and Morrow; Associate Professors Monson and Rothman; Assistant Professor Morrison; Lecturer Ellison

Teaching and Research Staff: Lecturers and Visiting Lecturers Feinleib, Jick, Li, Miller, Paffenbarger, Sartwell, and Warram; Research Associates Buring, Finkle, and Yen

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The major objective of the Department of Epidemiology is to provide opportunities for training and experience in the application of epidemiologic research methods to the investigation of diseases of unknown etiology. Emphasis is on the cardiovascular and mental disorders, the malignant neoplasms, abnormalities of reproduction and development, and other major diseases for which preventive measures are still unknown or inadequate.

One- and two-year research training programs lead to the degree of Master of Science in Epidemiology. For qualified students the period of research training may be extended by admission to either of the doctoral programs offered by the School, by admission to special student status, or through other individual arrangements. Most of the training period beyond the master's degree is occupied in supervised research experience. Potential doctoral candidates must plan at least two years in residence beyond completion of the master's degree. (For a description of programs leading to the degrees of Master and Doctor of Science in Epidemiology, see the section entitled "Admission and Degree Requirements and Academic Programs.")

A three-year residency in the Department of Epidemiology has been approved as satisfying residency requirements of the American Board of Preventive Medicine for certification in General Preventive Medicine. Requirements of the approved residency and of the School's degree programs may be satisfied simultaneously.

Epidemiology 201a. Principles of Epidemiology

Lectures. *Two 2-hour sessions each week. 2.5 units.* Dr. Cole, Staff of the Department.

This course consists of lectures supplemented with readings and exercises. The purpose is to familiarize students with epidemiologic concepts, especially those pertinent to the understanding and control of the chronic diseases.

Epidemiology 202b,c. Epidemiology Seminars

Seminars. *One 2-hour session each week. 2.5 units.* Dr. Morrison, Staff of the Department.

This course is intended as an extension of Epidemiology 201a. Principles and methods presented in 201a are considered in the context of substantive issues. Seminars will be oriented to areas of interest to enrolled students. Each student will make one or more presentations, based on a study design or a review of one or more papers in a substantive area.

Prerequisites: Epidemiology 201a and Biostatistics 101a. Enrollment is limited and is subject to the approval of the instructor.

Epidemiology and Biostatistics 203b. Principles of Epidemiologic Research I: Problem Conceptualization and Study Design

Lectures, seminars. *Two 2-hour sessions each week. 4 units.* Dr. Miettinen. With a detailed text in the background, the course utilizes simple examples and other illustrations to introduce the objects of epidemiologic research and the goals, options, and decision principles in study design. (A parallel tutorial course is available for those desiring in-depth study.)

Prerequisite: Epidemiology 201a.

Epidemiology and Biostatistics 203c. Principles of Epidemiologic Research II: Data Analysis and Inference

Lectures, laboratory. *Two 2-hour sessions each week. 3 units.* Dr. Miettinen.

Again with a detailed text in the background, the course exploits examples from actual studies to introduce the principles of hypothesis testing and estimation in epidemiologic research. (A parallel tutorial course is available for those desiring in-depth study.)

Prerequisite: Biostatistics 101a,b.

Epidemiology and Biostatistics 204c,d. Principles of Epidemiologic Research III: Applications

Tutorials, seminars. *Tutorial sessions during third period; one 2-hour seminar each week during fourth period. 2.5 units.* Dr. Rothman.

The seminars consist of student presentations of plans for and analyses of epidemiologic data, with discussion by students and faculty. Preparatory work is done under tutorial arrangements with members of the faculty. For the analyses, the emphasis will be on conceptual issues and not on execution.

Prerequisites: Epidemiology and Biostatistics 203b or Epidemiology 206b, and approval of the instructor.

Epidemiology 205c,d. Topics in Epidemiologic Research

Lectures. *One 2-hour session each week. 2.5 units.* Dr. Hutchison, Staff of the Department.

This course is intended for students who expect to conduct epidemiologic

research. It consists of lectures on topics that are not part of the basic methodology covered in other courses in the Department. Topics include sampling, factors affecting response, data handling, analysis of time-place clustering, cyclic variation, survival, and problems of distinguishing genetic and environmental components of a disease.

Prerequisites: Epidemiology 201a and Biostatistics 101a,b, or equivalent.

Epidemiology 206b. Epidemiologic Methods

Lectures. *Two 2-hour sessions each week. 2.5 units.* Dr. Rothman.

This course is intended for students at the master's level who wish to acquire a familiarity with epidemiologic methods. The principles of study design and data analysis are presented with examples and exercises. The emphasis is on practical rather than theoretical issues.

Prerequisite: Epidemiology 201a or equivalent.

Epidemiology 211c,211d. Epidemiology of Chronic Disease

Lectures. *One 2-hour session each week. 1.25 units each period.* Dr. Hutchison, Dr. Morrison.

This course is a review of the epidemiology of chronic diseases. It consists of two modules, either or both of which may be elected. One module is given in each period. The module in the third period is: cancer and screening (Dr. Morrison). The module in the fourth period is: cardiovascular and respiratory disease (Dr. Hutchison).

Epidemiology 212c,d. Environmental Epidemiology

Lectures, seminars. *One 2-hour session each week. 2.5 units.* Dr. Monson.

This course has three objectives: (1) to review methods used in evaluating the health effects of physical and chemical agents in the environment; (2) to review available evidence on the health effects of such exposures; and (3) to consider policy questions raised by the scientific evidence. Instruction will include lectures on methodology, seminars on the review and criticism of current literature, and presentations by outside experts on the evaluation and impact of epidemiologic data.

Prerequisites: Epidemiology 201a and Biostatistics 101a,b; Environmental Health Interdepartmental 201a, 201b recommended but not required.

Epidemiology 300a,b,c,d,e. Tutorial Programs

Time and credit to be arranged.

Students may participate in departmental research in close association with a staff member. Time and credit are to be arranged with the Head of the Department.

Epidemiology 350. Research

In selecting topics for research in doctoral programs, students should consider the fields in which members of the Department are currently working. These include:

Neoplastic disease (*Dr. MacMahon, Dr. Cole, Dr. Hutchison, Dr. Monson, Dr. Morrison*).

Congenital malformation (*Dr. MacMahon, Dr. Miettinen, Dr. Rothman, Dr. Yen*).

Cardiovascular disease (*Dr. Rothman, Dr. Miettinen*).

Effects of contraceptive agents (*Dr. Cole, Dr. Rothman*).

Environmental epidemiology (*Dr. Monson*).

Statistical methods (*Dr. Miettinen*).

DEPARTMENT OF HEALTH SERVICES

Isabelle Valadian, M.D., M.P.H., Professor of Maternal and Child Health and Acting Head of the Department

Faculty: Professors and Visiting Professors Curran, Densen, Haggerty, Roberts, Wray, and Yerby; Associate Professors Hsiao, Nesson, D. Neuhauser, Sahney, Sheldon, and Stason; Assistant Professors Deykin, Feldman, Fineberg, Fuhrer, Gortmaker, McAlister, Palmer, Radius, Taylor, Thompson, Walker, Weitzman, and Young; Lecturers Braun, Chase, Dwyer, Joseph, Kasten, Segall, Sherman, Strong, Trevelyan, and Yacovone

Teaching and Research Staff: Lecturers and Visiting Lecturers Allen, Alpert, Atamian, Bander, Barkin, Berarducci, Bishoff, Blumenthal, Boland, Burchfield, Bycoff, Cash, Cloherty, Cohen, Coombs, Cotton, Creasey, Cupples, Custer, Dolinsky, Dull, Earls, Entmacher, Levin-Epstein, Field, Fink, Gold, Goldman, Hafey, Hargreaves, Hassan, Hemenway, Holden, Johnson, Keith, Kelly, Komaroff, LaCasse, Levine, Liang, Liljestrand, Lion, Lorch, MacLeod, Martikainen, McLerran, Medina, Meehan, Messenger, Morris, E. Neuhauser, Newberger, Nighswander, Pyle, Rockoff, Rosenberg, Rosenthal, Ryan, Sands, Shapiro, Shepard, Silberman, Silversin, Simon, Smith, Storm, Stranova, Wathne, White, Yankauer, and Zanditon; Instructors Avorn, D. Barrett, Berwick, and Dumbaugh; Research Associates R. Butler, S. Thomas, and Winsten; Consultants Janeway and Livernash

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The goal of the Department of Health Services is to improve health care through education of future leaders in health services and through programs of research in developing and evaluating new community health systems. The Department offers two major areas of program specialization — health services administration and maternal and child health. These two areas represent the two departments which were combined to create the current Department of Health Services.

Although students may concentrate in either of these areas, the emphasis of the Department is upon the holistic nature of health services, including mental health services and services for special groups such as the handicapped, mothers and children, and the aged. The many disciplines relevant to health services are represented in the faculty — medicine, economics, law, political science, anthropology, psychology, sociology, public and business administration, and behavior change. Since the development of health policy, management of health systems, and development and evaluation of health services involve many academic disciplines, students may take courses in other parts of the University, such as the Medical School and schools on the Cambridge campus, to augment courses given at the School of Public Health.

In addition to the programs offered in the two areas listed above, the Program in Health Policy and Management (described on page 47), as well as the

Executive Programs in Health Policy and Management (described on page 17), are integrated with the Department of Health Services through faculty appointments. The former is an interdisciplinary two-year program which leads to the degree of Master of Science. It is based on core courses determined by the faculty; students in the program may also take as electives other courses offered by the School of Public Health, by other faculties at Harvard, and by the Massachusetts Institute of Technology. The Executive Programs in Health Policy and Management offers a series of nondegree programs designed to provide continuing education in health management, policy, planning, and regulation for executives involved in health care.

Division of Health Services Administration

The increasing complexity of medical services calls for diverse types of health organizations. The growth of organized health services has created an increased need for qualified administrators and researchers. A major goal of the division of health services administration is to provide education for leadership in health service organizations. Emphasis is placed on planning, organization, evaluation, and regulation of health services.

Special attention is given to macroadministration or the administration of health systems. Cross-national studies of health care systems are used as analytic tools to assist the student in gaining an appreciation of the universal nature of the determinants that govern organized activity for the delivery of health services.

Consideration is given to traditional administrative techniques as well as more recently developed quantitative and analytic methods. Since many problems, broad in scope, must be studied, the resources of multiple disciplines and several Harvard faculties are available for the student.

The division participates in programs leading to the degrees of Master and Doctor of Public Health and Master and Doctor of Science. (For a description of the programs leading to the degrees of S.M. and S.D. in Health Services Administration, see the section entitled "Admission and Degree Requirements and Academic Programs." A two-year interdisciplinary program leading to the degree of S.M. in Health Policy and Management is also offered, and is described in that same section.)

Please note that all courses in the division have recently been renumbered, in such a way that courses dealing with similar topics are grouped together. In registering for Health Services Administration courses during the 1978-79 academic year, students should be sure to use the new numbers. For reference purposes, the former number of each course (the number it was assigned during the 1977-78 academic year) is listed in parentheses following the course title.

Health Services Administration 201b,c. Health and Social Welfare Systems in Cross-National Perspective (formerly Health Services Administration 201b,c)

Lectures, seminars, case discussions. *Two 2-hour sessions each week. 5 units.* Dr. Yerby, Dr. Dieter Koch-Weser (Associate Professor of Preventive and Social Medicine, Harvard Medical School).

Modernization and industrialization have affected the health and economic security of individuals and families. Cyclic unemployment, industrial accidents and disease, temporary and permanent disability, and the social and financial deficits of old age are among the problems of modern nation states. The course examines the mechanisms that have evolved in different societies to ameliorate these hazards. The interrelatedness of health and social welfare programs and services is explored.

Health Services Administration 202a,b. Health Care Issues and Institutions (formerly Health Services Administration 202b,c,d and 309b,c)

Lectures, seminars. *Two 1½-hour sessions each week. 5 units.* Staff of the Department.

This course provides an overview of the structure of the health care delivery system and how its components can be integrated. Students develop skills in analyzing policy issues from an interdisciplinary vantage, including political, historical, social, and economic points of view. Readings include major writings in the field of health services research.

Required for students in the Health Policy and Management Program.

Health Services Administration and Behavioral Sciences 203a,b. Administration and Organization of Health Services (formerly Health Services Administration and Behavioral Sciences 203a,b)

Lectures, discussions. *Two 1½-hour sessions each week. 2.5 units each period.* Dr. Benfari, Dr. Neuhauser.

This course describes the character and the function of the managerial process in health organizations. The "a" period focuses on leadership, group process, motivation, and communication. The "b" period focuses on organizational design, control, and information systems. Either period may be taken separately.

Health Services Administration 204a,b. Political Analysis in Health Care (formerly Health Services Administration 244a,b) (Public Policy 244)

Lectures, discussions. *Two 1½-hour sessions each week. 5 units.* Dr. Fineberg.

Not given in 1978-79.

This course presents an introduction to political and bureaucratic considerations which affect the outcome of health programs. The course should improve the student's ability to predict the likely consequences of de-

partmental, agency, institutional, and individual actions. It should also improve the student's ability to plan more effective implementation of health programs. The course is appropriate for students who will be involved in planning, initiating, and managing health programs.

Health Services Administration 205d. The Health Maintenance Organization: Exploring an Alternative Care System (formerly Health Services Administration 210d)

Seminars. *Two 2-hour sessions each week. 2.5 units.* Dr. Nesson.

Recent national concerns with improving health care have promoted the HMO as an alternative care system. This course explores the background of this movement, its liabilities and progress, and the evolving legislation. Reading and materials are taken from operating plan experiences. A seminar format is used. The students, working in groups, will prepare proposals for the organizational, marketing, financial, and delivery programs of a newly developing HMO.

Enrollment is limited to 20 students and is subject to approval of the instructor.

Health Services Administration 206d. Quality Assurance in Health Services (formerly Health Services Administration 220d)

Lectures, discussions. *Two 1½-hour sessions each week. 2.5 units.* Dr. Palmer, Visiting Lecturers.

This course examines issues in defining "quality in health care" and the choice of methods for assessing and improving quality of health care. Recent research is reviewed and currently operating programs, including PSROs, are analyzed. Presentation includes case materials from quality assurance programs in both hospital and ambulatory settings.

Health Services Administration 207b. Sociological Perspectives in the Study of Health Attitudes and Behaviors (formerly Health Services Administration 218b)

Lectures, seminars. *Two 1½-hour sessions each week. 2.5 units.* Dr. Radius.

This course considers sociological literature and sociological variables as they contribute to our understanding of preventive, illness, and sick role behaviors. Consumer attitudes, within both the patient and general populations, are reviewed. Attention is directed to the methods and methodological constraints posed to research in this substantive area.

Prerequisites: Introductory sociology or equivalent, or permission of the instructor.

Health Services Administration 207c,d. The Sociology of Medical Care (formerly Health Services Administration 218c,d)

Lectures, discussions. *Two 1½-hour sessions each week. 5 units.* Staff of the Division.

Not given in 1978-79.

This course is organized along two major axes: (1) the importance of social factors as they bear on health and illness and as they affect the health care system; (2) the microsociological (clinical) and the macrosociological (societal) aspects of illness and its treatment. It is proposed to expose the students to clinical situations so that they will better understand the basic elements of the interaction between patients and health professionals.

Biostatistics and Health Services Administration 208c,d. Health Program Evaluation (formerly Biostatistics and Health Services Administration 216c,d)

Lectures, discussions. *One 2-hour session each week. 4 units.* Dr. Fuhrer, Dr. Waternaux.

(Course is described under Department of Biostatistics.)

Health Services Administration 209d. Issues in the Design and Implementation of Government Programs (formerly Health Services Administration 217d)

Seminars. *One 3-hour session each week. 2.5 units.* Dr. Feldman.

This course analyzes the policy choices which are inherent in government programs intended to change the behavior of health care providers. Cases are drawn primarily from planning and regulatory programs at the federal and state levels in the United States.

Health Services Administration 210c,d. Administration of Personal Health Service Programs (formerly Health Services Administration 211c,d)

Seminars, field projects. *One 2-hour session each week. 2 units.* Dr. Kasten.

This course is designed for students who will be administrators of personal health service programs. Inpatient, ambulatory, home, and rehabilitation programs are treated from an operational and preventive perspective. Special emphasis is placed on administrative problem solving. Students analyze administrative problems in operating personal care service programs.

Enrollment is subject to the approval of the instructor.

Health Services Administration 220b. Mental Illness: Films and Reality (formerly Health Services Administration 323b)

Films, lectures, discussions. *One 3-hour session each week. 1.25 units.* Dr. Neuhauser, Ms. Barkin, Dr. Rosenberg.

This course examines issues pertinent to the mental health field through the use of films. Topics include mental retardation, institutions, and substance abuse. Feature films are shown for each topic, followed by a

documentary and by a discussion with a person presently involved in problems such as those portrayed in the films.

Health Services Administration 220c. Current Issues in Mental Health Administration (formerly Health Services Administration 323c)

Lectures, discussions. *One 3-hour session each week. 2.5 units.* Dr. Neuhauser, Ms. Barkin, Dr. Rosenberg.

This course deals with therapeutic, ethical, financial, policy, and treatment issues inherent in the mental health system. Particular attention is given to these issues in context of the following: deinstitutionalization, homosexuality, the patient's perspective, legal issues, financing mental health care, and the state and federal view of the mental health system.

Enrollment is subject to the approval of the instructor. It is preferred that students have professional commitment and/or some experience in the mental health area.

Health Services Administration 220d. Current Issues in Mental Hospitalization (formerly Health Services Administration 323d)

Lectures, discussions, site visits. *One 2½-hour session each week. 2.5 units.* Dr. Neuhauser, Ms. Barkin, Dr. Rosenberg.

This course focuses on issues related to planning, organizing, directing, and controlling psychiatric and other mental health services. Attention is given to these issues in context of the following: mental health services in the public, private, government, and criminal justice sectors, and community mental health. The course includes on-site visits to facilities that demonstrate these issues, as well as presentations by leaders in the field from Massachusetts.

Enrollment is limited to 15 students and is subject to the approval of the instructor. Preference is given to students with professional commitment and/or some experience in the mental health area.

Health Services Administration 228a,b; 228c,d. Health Education (formerly Health Services Administration 205a,b; 205c,d)

Seminars. *One 2-hour session each week. 2.5 units each semester.* Staff of the Division.

Not given in 1978-79.

This course is designed primarily for program administrators and emphasizes major aspects of learning theory, communication theory, educational methods, and health behavior; health education in the process of social change; psychosocial and cultural factors relevant to planning of health education programs; and research and evaluation in health education.

The course is repeated in the third and fourth periods.

Health Services Administration 230c,d. Health Law and Public Policy: Regulation of the Health Care Industry (formerly Health Services Administration 206c,d)

Seminars. *One 2-hour session each week. 2 units.* Dr. Curran.

This course covers the application of law and legislative process to the establishment of public policy in health fields such as medical care delivery systems, health manpower, health facilities, and medical care financing. Special attention is given to regulation of quality in health care, consumer involvement, and equality of access to health systems. A case analysis method is employed.

Health Services Administration 232a,b. Dental Public Health Practice (formerly Health Services Administration 207a,b)

Seminars, field visits. *One 2-hour session each week. 2.5 units.* Dr. Yacovone.

This seminar provides in-depth training in the administration and planning of dental health programs. Subjects covered include community needs, resources, surveying, fluoridation, prepayment, and program evaluation. Each student develops a program plan in a specific area of community dental needs and presents the plan to the class.

Health Services Administration 233c,d. Dentistry and Social Policy (formerly Health Services Administration 303c,d)

Lectures, seminars. *One 2-hour session each week. 2.5 units.* Dr. Yacovone.

This course investigates relationships between the social sciences and dentistry. Subjects considered include the role of the social sciences in dentistry, psychosocial interaction of doctor and patient, client perceptions of dentistry, interpersonal relationships in group practice, and the sociopolitical influence of dentistry as an organization.

Population Sciences and Health Services Administration 235c,d. The Design and Management of Population Programs (formerly Population Sciences and Health Services Administration 207c,d)

Case discussions, seminars. *Two 2-hour sessions each week. 5 units.* Dr. D. Korten, Dr. F. Korten, Dr. Wyon, Staff of the Department of Population Sciences.

(Course is described under Department of Population Sciences.)

Health Services Administration and Maternal and Child Health 237a,b. Child Development and Social Policy (Education P-220)

Seminars. *Two 2-hour sessions each week. 5 units.* Dr. Walker.

This course analyzes how knowledge of child development relates to the planning and implementation of social policy. Of primary concern is the

relevance and utility of basic data from research and evaluation studies in psychology, pediatrics, and related disciplines in the creation of health and education programs and policies concerned with children and adolescents.

Prerequisite: Knowledge of basic child development and of research methodologies and strategies.

Health Services Administration and Biostatistics 241a,b. Statistical Methods for Health Policy and Management (formerly Interdepartmental 214a,b)

Lectures. *Two 1½-hour sessions each week. 5 units.* Dr. Thibodeau.

This course provides an introduction to statistics and probability emphasizing their application in a variety of health policy and management contexts. Goals include establishing an awareness of basic statistical reasoning and recognition of common difficulties in application. Topics include distributions, analysis of studies, inference (estimation and hypothesis testing), and applied regression analysis. Time-sharing computing will be used throughout.

Prerequisite: One college-level course in mathematics. Enrollment of students not in the Health Policy and Management Program is subject to approval of the instructor.

Required for students in the Health Policy and Management Program.

Health Services Administration and Biostatistics 241c,d. Quantitative Methods for Health Policy and Management (formerly Interdepartmental 214c,d)

Lectures, discussions. *Two 1½-hour sessions each week. 5 units.* Dr. Sahney, Dr. Thompson.

The purpose of this course is to provide students with motivation to analyze health care problems quantitatively. Techniques covered include linear programming, queueing theory, simulation, decision analysis, and cost benefit analysis. General understanding of a broad range of quantitative techniques and ideas and a capacity to evaluate the power and limitations of quantitative analysis is the goal.

Prerequisite: Health Services Administration 241a,b or permission of the instructor.

Required for students in the Health Policy and Management Program.

Health Services Administration 242c,d. Community Health Data: Collection and Analysis (formerly Health Services Administration 306c,d)

Seminars. *Two 1½-hour sessions each week. 5 units.* Dr. Gortmaker.

This course explores practical issues encountered in the collection and dissemination of health data within communities in the United States, and generates experience in the collection and interpretation of these data. Subjects covered include: measures of health status and process, as-

sessment of data quality, data available at the community level, data collection instruments, costs of data collection, and the computer processing of large data files.

Prerequisite: Introductory statistics course.

Health Services Administration and Biostatistics 243c. Analysis of Health and Medical Practices (formerly Health Services Administration and Biostatistics 290c) (Public Policy 290)

Lectures, discussions. *Two 1-hour sessions each week. 2.5 units.* Dr. Milton C. Weinstein (Associate Professor of Public Policy, John F. Kennedy School of Government).

This course concerns the analysis of clinical procedures and health programs, and examines uses and limitations of quantitative methods such as decision analysis and cost-benefit analysis. Topics include: resource allocation in the management of hypertension; treatment decision for acute abdominal pain; diagnosis of renovascular disease; screening for glaucoma; coronary artery bypass surgery. Implications for quality assurance and medical reimbursement policies are considered.

Prerequisite: Some facility with quantitative methods, preferably with some elementary knowledge of statistics, decision analysis, or economics.

Health Services Administration 250a,b. Economic Analysis (formerly Health Services Administration 208a,b)*

Lectures, discussions. *Two 1½-hour sessions each week. 5 units.* Staff of the Department.

This course is an introduction to microeconomic analysis, with the goal being for students to understand the way economists approach problems, to become comfortable with simple microeconomic models and concepts, and to recognize their uses and limitations. The course is largely a "tools" course and should provide a solid understanding of such economic concepts as "opportunity cost," "externalities," and "marginal analysis."

Required for students in the Health Policy and Management Program.

*To assist students in deciding which courses to take, the following explanation is offered of differences between the various courses dealing with economics of health.

Health Services Administration 252a,b is designed to introduce one-year students who do not intend to take further economics courses to the basic analytical framework as it is relevant to the problems and issues in public health. Health Services Administration 250a,b is designed for students who do intend to take further courses in economics. It is required for all students in the Health Policy and Management Program and suggested for those who expect to take one of the applied or advanced courses in health economics.

Health Services Administration 250c,d, 251c,d, and 253d presume prior knowledge of basic economics and are designed primarily to apply economic analysis to health sector problems and issues. Health Services Administration 251c,d involves the application of economic analysis and quantitative methods to health planning.

Health Services Administration 250c,d. Economics of Health Services (formerly Health Services Administration 208c,d)

Lectures, discussions. *Two 1½-hour sessions each week. 5 units.* Dr. Taylor.

This course is designed to provide an examination of the economic aspects of the production, distribution, and organization of health services. The course is devoted to applying the framework of economic analysis to the health services sector. Topics normally covered include the supply and demand of medical care facilities, markets for health manpower, financing of medical care, cost-benefit analysis, and problems of health planning.

Prerequisite: Health Services Administration 250a,b or equivalent.

The "c" period is required for students in the Health Policy and Management Program.

Health Services Administration 251c,d. Economics of Health Planning (formerly Health Services Administration 209c,d)

Seminars. *Two 1½-hour sessions each week. 5 units.* Mr. Hsiao, Dr. Shepard.

This course applies economic analysis to planning of health programs. Application is emphasized over theory. The course examines planning and regulation in a market economy, and develops analytical tools including econometrics, modeling, simulation, and cost-benefit analysis. Planning topics include health manpower, resource allocation, hospital facilities, and national health insurance. Skills in using analytical techniques appropriately are developed. Case study material is used.

This course is especially appropriate for students who intend to pursue a career in planning and evaluation of health programs.

Prerequisites: One semester each of statistics and microeconomics.

Health Services Administration 252a,b. Economic Analysis for Public Health (formerly Interdepartmental 210a,b)

Lectures, discussions. *Two 1½-hour sessions each week. 5 units.* Dr. Taylor.

This course provides an introduction to the basic principles of economics and economic analysis, particularly as they apply in the public health field. A systematic introduction to microeconomic theory includes the determinants of supply and demand, the theory of markets, and the concept of economic efficiency. In addition, attention is given to public expenditures and policy analysis.

Health Services Administration 253d. Seminar in Economics for Health Policy Analysis (formerly Health Services Administration 311d)

Seminars. *One 3-hour session each week. 2.5 units.* Dr. Taylor.

This course focuses on topics in the economics of health policy. Themes

vary from year to year, but typically include econometric models, the role of government in the health sector, analysis of government regulatory programs, the production of physicians' services, distributional aspects of national health insurance, and the market for blood in the United States.

Prerequisites: Health Services Administration 250a,b, the "c" period of Health Services Administration 250c,d, Health Services Administration and Biostatistics 241a,b (or equivalents), and permission of the instructor.

Health Services Administration 260a,260b,260c,260d. Introduction to Control and Finance (formerly Health Services Administration 212a,212b, 212c,212d)

Lectures, discussions. *Two 1½-hour sessions each week. 2.5 units each period.* Dr. Young, Dr. Atamian.

This course enables students to understand how accounting and financial data are generated and used, and how the results of operations are reported. Subjects include financial accounting ("a" period); cost accounting ("b" period); financial and capital investment analysis and long-term finance ("c" period); and management control systems, including budgeting, performance reporting and evaluation, and management information systems ("d" period). A case analysis method is used.

Prerequisites: The "a" period module or its equivalent is a prerequisite for the "b" and "c" periods; the "b" period module or its equivalent is a prerequisite for the "d" period.

Health Services Administration 261d. Health Care Operations Management (formerly Health Services Administration 313d)

Lectures, case studies, discussions. *Two 1½-hour sessions each week. 2.5 units.* Dr. Sahney.

The objective of this course is to familiarize the students with a variety of operating systems in a health care environment and to present significant issues related to the types of decision situations a health care manager faces in practice. Subjects include: labor productivity monitoring, resource management, information systems evaluation, materials management, nursing staffing, elective admissions scheduling, operating room scheduling, and hospital drug distribution systems.

Prerequisites: Basic course in statistics or quantitative methods, or permission of the instructor.

Health Services Administration 262d. Reimbursement Systems (formerly Health Services Administration 328d)

Seminars. *One 3-hour session each week. 2.5 units.* Dr. Young.

This course examines issues related to the general theme of third-party reimbursement for health care institutions. The principal focus is on hospitals. Issues covered include cost containment efforts, hospital

perspectives, and the role of incentives. Some specific systems are examined in detail in order to assess the feasibility of certain techniques and to address questions of overall reimbursement system design.

Prerequisites: Health Services Administration 260a, 260b or equivalent, or permission of the instructor.

Health Services Administration 263c. Strategic Issues in Personnel Management (formerly Health Services Administration 326c)

Discussions. *Two 1½-hour sessions each week. 2.5 units.* Staff of the Department.

This course concentrates on personnel's changing role and on frontier and basic aspects of personnel management. Through case studies, films, guest speakers, and discussions, selected topics are covered, including personnel function, grievance procedures, wage and salary administration, job enrichment, Equal Employment Opportunity, occupational safety and health, appraisal systems and management by objectives, flexible benefits, and university personnel administration.

(Note: Dr. Livernash is the principal instructor for this course.)

Health Services Administration 264a,b. Labor Relations: Issues in Collective Bargaining (formerly Health Services Administration 327a,b)

Case discussions. *Two 1½-hour sessions each week. 5 units.* Staff of the Department.

This course emphasizes the grievance, arbitration, and negotiation processes, developing the students' knowledge of selected substantive areas through case studies. A negotiation exercise by student union and management teams provides meaningful insights. Public sector and health care cases highlight special industry characteristics. The course concludes by examining the role of collective bargaining in health care institutions.

(Note: Dr. Livernash is the principal instructor for this course.)

Health Services Administration 265c. Government and Private Funding for Research and Health Care Programs

Lectures, discussions, workshops. *One 2½-hour lecture each week and one 1-hour workshop every two weeks. 2.5 units.* Staff of the Department.

To carry out research or develop needed health care programs, managers and policy analysts need to be able to obtain funding from federal, state, and local sources, and from foundations and corporations. This course aims to enable participants to demonstrate in a clear and concise proposal an understanding of the issues and facility with methodological design. Requirements for proper administration of funds are also discussed. Proposals are prepared and critiqued in the workshops.

Prerequisites: Exposure to research issues in health care or program development and permission of the instructor.

(Note: Dr. Dumbaugh is the principal instructor of this course.)

Health Services Administration 270a,b,c,d. Applied Research Project and Seminar

Seminars. *One 2-hour session each week.*

Field work. *One day each week. 10 units.* Staff of the Department.

The purpose of the applied research project is to provide students with expanded opportunities for working and learning in an operational setting. In the seminar faculty and preceptors from a variety of organizations discuss cases which relate thematically to the field work experiences. Two research reports are required.

Prerequisite: Completion of the first year of the Health Policy and Management Program.

Required for students in the Health Policy and Management Program.

(Note: Dr. Dumbaugh is the principal instructor of this course.)

Health Services Administration 300a,b,c,d,e. Tutorial Programs

Time and credit to be arranged.

Students may make arrangements to do individual and group work under the guidance of a staff member of the division. This work can include readings and special projects. In addition, field assignments to federal, state, and local government and to private health organizations can be arranged.

301 *Doctoral Seminar.* Dr. Radius.

302 *Research in Special Topics on Behavioral Change.* Dr. McAlister.

303 *Seminar in Health Manpower Analysis.* Dr. Wechsler, Staff of the Division.

304 *Special Projects in Health Services Administration.* Dr. Neuhauser.

305 *Health Economics for Developing Countries.* Dr. Hsiao, Dr. Shepard. This group tutorial is designed for students interested in applying economic analysis to health issues in developing countries. In weekly meetings, selected concepts and techniques of microeconomics and cost-effectiveness analysis are first presented and then applied to health programs in developing countries. Students gain some practice in using these analytical concepts through problem sets. No previous background in economics is required.

Health Services Administration 330e. Assignments to Field Agencies

Students are assigned to work on special projects, such as group surveys, other types of field projects, or observation of and limited participation in

the work of health agencies. Field assignments are made on an individual basis to meet the special needs of each student insofar as possible. Work in the field is coordinated with courses in the division. Two of the field placements available to students are listed below.

331 *Organization, Delivery, and Financing of Health Services in the Province of Quebec.* One-week period between fall and spring terms. 1 unit. Dr. Yerby.

332 *Cooperative Health Improvement Project.* Summer full-time or weekly part-time placement in local communities. Credit to be arranged. Dr. Haggerty.

Health Services Administration 350. Research

Doctoral candidates may register for Health Services Administration 350 to undertake individual study and research.

Division of Maternal and Child Health

The division of maternal and child health is concerned with education and research in health services for mothers and children as a part of general health services and as they relate to other service systems (especially social services and education). Planning for the delivery of personal health and social services to mothers and children depends upon knowledge of:

1. The aspirational values which society places upon them, their special vulnerability to biological and environmental hazards, and the successive phases of biological change (growth and development);
2. The social situation and the way in which social services function as they affect the health of children and influence the child-care capability of families;
3. The health aspects of centers of early childhood education, and traditional and innovative practices in elementary and high schools.

The courses and tutorial work offered by the division are focused on actions which these characteristics demand for planning, administration, and evaluation of health care services. Maternal and child health services at international, national, and local levels, including services for handicapped children, are discussed in terms of integration with related health services in the community. In connection with this focus, the important roles of national governments, local health agencies, voluntary organizations, and community consumer groups are considered in seminars, observations of service programs in operation, or study of reports of such programs, foreign as well as domestic.

The division participates in the programs leading to the degrees of Master and Doctor of Public Health and Master and Doctor of Science. (For a description of the programs leading to the degrees of S.M. and S.D. in Maternal and

Child Health, see the section entitled "Admission and Degree Requirements and Academic Programs.") Fellowships are available for U.S. students who are concentrating in maternal and child health.

Maternal and Child Health 101. Child Growth and Development

Self-instructional course. May be taken any period. 2.5 units. Dr. Valadian.

Individualized instruction in the physical growth, development, and maturation of children is presented in self-paced programmed material, supplemented as needed by conferences. The course covers topics which are necessary for advanced study of growth and development and which are basic for students who plan to be involved in medical or related social and educational services for children.

Maternal and Child Health 201b,201c. Child Growth and Development II: Advanced Seminar

Seminars. *One 2-hour session each week. 2.5 units (or 1.5 units if only one period elected).* Dr. Valadian.

This advanced seminar deals in depth with the physical growth and development and the maturation of children ("b" period) and with the factors affecting them ("c" period). Either period may be taken separately. A term paper is required of all students, whether they take the "b" period, the "c" period, or both, and may be done in either period.

Prerequisite: Maternal and Child Health 101 or permission of the instructor.

Maternal and Child Health 202b. Primary Maternal and Child Health Care

Seminars, field visits. *One 2-hour session each week. 1 unit.* Dr. Valadian, Staff of the Division.

Seminars and field observations focus on four different health programs in Boston. Faculty members participate in the visits and seminars, which are intended to relate the observed activities to maternal and child health and to crippled children's programs.

Maternal and Child Health 203b. Content of Maternal and Child Health Services

Seminars. *Two 2-hour sessions each week. 2.5 units.* Dr. Valadian, Dr. Neuhauser, Staff of the Division, Guest Lecturers.

Components of health care services to mothers and children are discussed as they vary to meet the changing needs resulting from growth and maturational processes. Health services appropriate to maternity, early and late childhood, adolescence, and youth are presented in terms of the multidisciplinary and interdisciplinary action they require.

Prerequisites: Completion of Maternal and Child Health 101, simultaneous enrollment in Maternal and Child Health 201b, or permission of the instructors.

Maternal and Child Health 204c,d. Programs and Issues in Maternal and Child Health Services

Lectures. *Two 2-hour sessions each week. 5 units.* Dr. Valadian, Dr. Neuhauser, Staff of the Division, Guest Lecturers.

Beginning with the historical background and the relationship of maternal and child health programs to social, mental health, education, and other systems, the course discusses factors which shape current and future maternal and child health policies and services. It considers the organization and administration of national, state, and local maternal and child health and handicapped children services and examines selected issues such as child abuse, lead poisoning, and day care.

Prerequisites: Maternal and Child Health 201b and 203b or permission of the instructors.

Maternal and Child Health 205d. Research Approach to Growth, Development, and Health of the Child

Seminars. *Two 2-hour sessions each week. 2 units.* Dr. Valadian, Dr. Reed.

Methods of obtaining and evaluating data on child growth, development, and health, and the construction of norms are studied, including the design of studies dealing with interrelationships among various aspects of the child's progress, background, and environment.

Enrollment is subject to the approval of the instructor.

Maternal and Child Health 206c,d. Maternal and Child Health in Developing Countries

Seminars. *One 2-hour session each week. 2.5 units.* Dr. Wray.

Using readings, discussions, and case presentations, this course considers issues of high priority in the health of mothers and children in developing countries, placing particular emphasis on the interactions between health and poverty in societies in rapid social and cultural transition. This course complements, but is not a substitute for, the issues raised in Interdepartmental 209a,b. Considerable reading is required to fulfill the course objectives.

Maternal and Child Health and Nutrition 207c,d. Nutrition in Child Growth and Development

Lectures, discussions. *One 2-hour session each week. 2.5 units.* Dr. Dwyer, Visiting Lecturers.

Principles and practical problems encountered in the nutritional aspects of child growth and development are examined. Lectures on general principles are designed to help students base their judgments on scientific evidence. Discussions deal with a variety of nutrition case studies and simulations illustrative of problems in both developing and highly industrialized countries.

Maternal and Child Health 208c,d. Rural Health Services

Seminars. *One 2-hour session each week. 2.5 units.* Dr. Wray, Dr. Wyon. Discussion focuses on the characteristics of "rural culture" and on problems in identifying and providing for the health needs of isolated communities. Five areas of concern are examined: Appalachia, the black South, migrant workers, Indian health, and the rural not-poor. However, the concepts discussed are pertinent to developing countries as well as the United States. After covering common issues, students work in small groups focusing on selected areas of interest. Field visits can be arranged.

Health Services Administration and Maternal and Child Health 237a,b. Child Development and Social Policy (Education P-220)

Seminars. *Two 2-hour sessions each week. 5 units.* Dr. Walker.

(Course is described under Division of Health Services Administration.)

Maternal and Child Health 300b,c,d,e. Tutorial Programs

Time to be arranged. 2 or more units.

Students may arrange to undertake an individual project or specialized reading under faculty supervision. Possible topics include: planning and evaluating health care services for mothers and children; social services; child growth and development. Advance approval by the Head of the Department of Health Services is required.

Maternal and Child Health 330. Field Study

One-week period between fall and spring terms. 1 unit.

Field study will be arranged on an individual basis to meet the special needs of each student insofar as possible.

Additional Field Study

Students who lack sufficient previous experience are encouraged to undertake a period of field study before registration or after completion of the academic year, in a program arranged by the staff of the division. No credit is allowed for such field study.

Maternal and Child Health 350. Research

Doctoral students may undertake research in maternal and child health by arrangement with the Head of the Department of Health Services.

DEPARTMENT OF MICROBIOLOGY

M.E. Essex, D.V.M., Ph.D., Associate Professor of Virology and Head of the Department

Faculty: Professor Nichols; Associate Professors Cerny, Essex, MacDonald, and Vinson; Assistant Professors Eisenstadt, Fraser, Grant, Haseltine, Herrmann, and Plate; Lecturers Madoff and Modabber

Teaching and Research Staff: Visiting Lecturers Fiumara, Gilfillan, Grady, and Wright; Instructor M. Benfari; Research Associates Cotter, Girard, Greenberger, and Stiller; Assistants McComb, Rota, and Spielman

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The emphasis in the Department of Microbiology is on training in research leading to the degree of Doctor of Science in Microbiology, with specialization in a particular area (see the program descriptions included in the section entitled "Admission and Degree Requirements and Academic Programs"). Doctoral research generally focuses on a topic related to one of the areas in which Department faculty are conducting research. These include: rickettsiae and chlamydiae (Drs. Nichols and MacDonald); cellular immunology (Drs. Cerny, Plate, and Grant); viral oncology (Drs. Essex and Haseltine); immunochemistry (Drs. MacDonald and Herrmann); cancer biology and mutagenesis (Drs. Eisenstadt, Essex, Cerny, and Haseltine); water-borne viruses (Drs. Herrmann and Nichols); and tumor immunology (Drs. Grant, Cerny, Essex, and Plate).

Tropical Public Health and Microbiology 201a. Ecology, Epidemiology, and Control of Important Parasitic and Viral Diseases of Developing Areas

Lectures, seminars, demonstrations; laboratory elective. *Four 1-hour sessions and one 2-hour elective laboratory session each week. 2.5 units; 3.5 units if laboratory elected.* Dr. Weller, Staff of the Department.

(Course is described under Department of Tropical Public Health.)

Microbiology and Tropical Public Health 201b. Decision Making in the Control of Infectious Diseases of Public Health Importance

Lectures, workshops. *One 1-hour and two 2-hour sessions each week. 2.5 units.* Dr. Nichols, Guest Lecturers.

Case studies are given of how policy is made and decisions are reached in attempts to control infectious diseases. Information is utilized in a spectrum ranging from molecular biology through epidemiology and resource allocation to cultural and socioeconomic factors. Cholera, venereal diseases, antibiotics in animal feeds, recombinant DNA, rubella, and trachoma *inter alia* are studied.

This course complements Tropical Public Health and Microbiology 201a, and is offered under the auspices of the Center for the Prevention of Infectious Diseases.

Microbiology and Tropical Public Health 202b. Critiques of Current Literature on Infectious Diseases

Seminars. *One 2-hour session each week. 1 unit.* Dr. Chernin, Dr. Herrmann, Staffs of the Departments.

Papers on topics of general interest are selected from current periodicals and critically reviewed as to soundness of experimental design, validity and significance of results and conclusions, organization of manuscripts, and clarity of presentation.

Enrollment of nondepartmental students is subject to the approval of the instructors.

Microbiology 203d. Clinical Problems in Infectious Diseases

Lectures, clinics. *One 2-hour session each week. 1 unit.* Dr. Louis Weinstein (Visiting Professor of Medicine, Harvard Medical School).

Problem cases concerning diagnosis, treatment, and control of the common acute communicable diseases of temperate climates are presented, together with discussions of infectious diseases that are usually not considered communicable.

Microbiology 204b. Laboratory and Immunologic Aspects of Infectious Diseases

Lectures. *Two 1-hour sessions each week.*

Laboratory. *Two 2-hour sessions each week. 2.5 units.* Dr. Herrmann, Dr. MacDonald, Ms. Rota.

This course introduces the microbiologic and immunologic techniques currently utilized by research and diagnostic laboratories for studying infectious diseases. Characterization and diagnosis of infectious agents of current public health importance are stressed, as well as the immunological principles involved. Students perform in detail cultural and biochemical techniques for viruses, bacteria, and rickettsiae, and a variety of relevant immunological techniques.

Enrollment is subject to the approval of the instructor.

Microbiology 207a. Current Topics in Immunology: Theory and Application

Lectures. *One 2-hour session each week. 1.25 units.* Dr. Cerny, Dr. Grant, Dr. MacDonald, Dr. Plate.

The important advances in immunology are selected and studied in depth each year. Both theory and applicability are discussed. In 1978 topics include regulatory idiotype network, idiotypes and T-cell receptors, lymphocyte collaboration (current status), T-cell products and intermediary

pathways, hormone receptors, immune surveillance (current status), and tumor-associated suppressor cells. The course requires six hours a week of outside reading. Evaluation is on the basis of a paper.

Prerequisite: Basic course in immunology and permission of the instructor.

Microbiology 208c,d. Immunology of Infectious Diseases

Lectures, discussions. *Three 1-hour sessions each week. 5 units.* Dr. MacDonald, Dr. Cerny, Staff of the Department, Guest Lecturers.

This course begins with introductory sessions and readings that review basic immunology. Selected groups of diseases are then explored in relation to immunological defense mechanisms. Examples include mucosal infections such as gonorrhea and trachoma, streptococcal infections, mycobacteria, viral infections including oncogenic viruses, and parasitic infections. Lectures are followed by assigned student discussions. Students prepare written grant proposals.

Prerequisites: A course in microbiology; a basic course in immunology is recommended. Enrollment is subject to the approval of the instructor.

Microbiology 213d. Intracellular Microorganisms Pathogenic for Man

Laboratory exercises, seminars. *Two 3-hour sessions each week. 2.5 units.* Dr. Herrmann, Dr. Nichols, Ms. Rota, Staff of the Department.

This course provides an understanding of the techniques available for studying the growth and the characteristics of representative strains of rickettsiae, chlamydiae, and viruses which are human pathogens. Under staff supervision, each student performs the procedures for identification and characterization of unknown pathogens.

Prerequisite: Microbiology 204b or equivalent. Enrollment is limited to 16 students with prior approval of the instructors. The course will not be given if less than 4 students enroll.

Tropical Public Health and Microbiology 214c,d. Case Studies in Epidemiology of Infectious Disease

Seminars, laboratory exercises. *One 2-hour session each week. 2.5 units.* Staffs of the Departments.

(Course is described under Department of Tropical Public Health.)

Microbiology 215d. Problems in Medical Bacteriology

Seminars, laboratory demonstrations. *One 3-hour session each week. 1 unit.* Staff of the Department.

Not given in 1978-79.

This course covers bacteriologic problems of particular interest to students which are not considered in Tropical Public Health and Microbiol-

ogy 201a and Microbiology and Tropical Public Health 201b. Course content is assembled around the students' interests. The course is given only if the instructor receives at least six individual requests before the end of the second quarter.

Microbiology and Tropical Public Health 216d. Sexually Transmitted Diseases

Lectures, seminars. *One 2-hour session each week. 1 unit. Additional credit may be arranged.* Dr. Nichols, Guest Lecturers.

Discussion centers on why sexually transmitted diseases that are easily cured are out of control. Reviewed topics include pathobiologic, epidemiologic, and biosocial aspects of venereal diseases, such as patterns of sexual behavior, lay and professional attitudes toward venereal disease and patients, and legal and economic aspects of control. Interaction of students from both social and medical sciences benefits the examination of possible new approaches for dealing with the problems.

Microbiology and Tropical Public Health 217d. Virology

Lectures, seminars. *Three 1-hour sessions each week. 2.5 units.* Dr. Essex, Dr. Waner.

The course is structured to provide students with fundamentals of human virology and introduces the new and relevant concepts emanating from recent and ongoing research. Topics include virus-host cell interaction, pathogenesis, chronic and latent infections, epidemiology, environmental factors, host defense mechanisms, and community control measures. Selected virus groups are discussed in detail.

Microbiology 219c,d. The Molecular Biology of Cancer (Biophysics 203)

Lectures. *One 2-hour session each week. 2.5 units.* Dr. Haseltine, Dr. Chen (Assistant Professor of Pathology, Harvard Medical School).

This course examines the nature of cancer at the molecular level. The differences between normal cells and tumor cells and in tissue culture are explored. The course draws upon cell biology, viral oncology, tumor immunology, and genetics. Specific topics include viral and chemical carcinogenesis, genetics of cancer and the transformed state.

Prerequisites: Previous training in biochemistry, cell biology, and virology, and permission of the instructor.

Microbiology 300a,b,c,d. Tutorial Programs

Time and credit to be arranged. Staff of the Department.

Enrollment requires the consent of the staff member responsible for supervision of the research. The various subject areas are listed below by category.

301 *Chlamydiae.* Dr. MacDonald, Dr. Nichols.
Laboratory and field research in trachoma, inclusion conjunctivitis, psittacosis, lymphogranuloma venereum, and the diseases caused by the chlamydial agents in humans and animals. Students are welcome to do laboratory and, occasionally, field investigations.

302 *Viruses.* Dr. Essex, Dr. Herrmann, Dr. Cerny, Dr. Fraser.
Isolation and identification of representative viruses by use of cell culture, animal inoculation, and serologic techniques.

303 *Immunochemical Methods.* Dr. MacDonald, Dr. Herrmann.
Experiments with immunofluorescence, chromatography, immunoelectrophoresis, enzyme-coupled antibody, labeled isotopes, and other techniques applied to research on microorganisms and mechanisms of hypersensitivity.

304 *Public Health Laboratory.* Associates at the State Laboratory Institute.
The State Laboratory Institute is engaged in a variety of programs related to public health. These include the development, preparation, and testing of new and standard serums, vaccines, and blood fractions; research in various aspects of applied immunology; various aspects of diagnostic service in the fields of bacteriology, virology, and congenital metabolic disorders; and field studies on arboviruses. Individual arrangements for study can be made in any of these programs.

305 *Tumor Biology.* Dr. Essex, Dr. Cerny, Dr. Grant.
Approaches and techniques for the study of cancer as an infectious disease. Procedures used to study tumor cell and tumor virus marker antigens and antibodies are demonstrated. The significance of these markers for epidemiological, etiological, and diagnostic investigations of various tumor systems of known and unknown cause is discussed. The relationship between the immune response and the oncogenic process is also examined.

306 *Cellular Immunology.* Dr. Cerny, Dr. Essex, Dr. Grant.
Differentiation of cells producing antibody of various classes *in vivo* and *in vitro.* The studies involve the use of a number of immunological methods, but principally the agar plaque technique. The major experimental model utilized is immune response to cell wall antigens of *Vibrio cholerae.* The research also involves experiments on interaction between antibody-forming cells and leukemic viruses in mice and studies on mechanism of virus-induced immunosuppression.

307 *Venereal Disease.* Dr. Nichols.
The departmental research on venereal diseases, especially gonorrheae, and the chlamydial diseases spans biology, immunology, microbial physiology, and epidemiology. Student participation in ongoing project areas is encouraged.

308 *Health Problems in Selected Underdeveloped Countries.* Dr. Nichols.
Problems are studied in the historical context of their political, socioeconomic, and cultural development. Extensive reading assignments are discussed in small seminars. Students with experience in international health are preferred.

Microbiology 350. Research
Qualified doctoral candidates, research fellows, and full-time special students may register for Microbiology 350 to undertake original research in virology, rickettsiae, bacteriology, immunology, or in one of the disciplines available at the State Laboratory Institute. A number of the current research activities of the Department of Microbiology are indicated under Microbiology 300. Inquiries about specific research opportunities should be addressed to the Head of the Department.

DEPARTMENT OF NUTRITION

Robert P. Geyer, S.B., S.M., Ph.D., Professor of Nutrition and Head of the Department

Faculty: Professors Hegsted, Lown, Stare, and Timmer; Associate Professors Antoniades, Hayes, and Herrera-Acena; Assistant Professors el Lozy, Mora, Thenen, Verrier, and Witschi; Lecturers Austin and Huber

Teaching and Research Staff: Visiting Lecturers Gershoff, Sachdev, and Samonds; Research Associates Ausman, Boelkins, Chu, DeSilva, Gallina, Graboys, Lynch, Nicolosi, Rabinowitz, and Remmell; Consultants Cannon and McGandy; Assistants Bruno, Duffett, and Gallagher

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The Department of Nutrition is concerned with basic and applied investigations in the science of nutrition with orientation towards problems of contemporary public health importance. These include cardiovascular disease, obesity, and diabetes. The Department is concerned with other areas of nutrition as well, such as policy, planning, economics, and applied interventions. There has also been a long-standing interest in health problems related to general nutrition both in this country and in Central and South America, Africa, and Asia. Research activities of the Department faculty are listed under the course number "Nutrition 350."

The Department offers several degree programs that are described in the section of the catalog entitled "Admission and Degree Requirements and Academic Programs." One of these programs is designed for highly qualified individuals intent on earning a doctoral degree and interested in laboratory-oriented approaches to solving nutrition and metabolic problems. By utilizing a number of scientific disciplines and engaging in appropriate research, students in this program learn and use the latest techniques in nutrition, biochemistry, physiology, and related fields. The research, whether basic or applied, is relevant to human health. Successful completion of the program leads to the degree of Doctor of Science in Nutrition. (Students with a bachelor's degree may be admitted directly into the Doctor of Science program.)

Students interested in earning the Doctor of Public Health degree in an area dealing with nutrition should contact the Department for information.

Other students may choose to combine the study of health policy and management with that of nutrition, earning the degree of Master of Science in Nutrition and Health Policy and Management at the end of two years of residence at the School. By taking basic relevant courses in both areas, students learn to deal effectively with the many nutrition-related problems that are arising on both local and national levels.

Finally, two new Doctor of Science programs are being developed and are under consideration for introduction into the School's curriculum. One will

combine nutrition and epidemiology and will offer excellent grounding in these two disciplines. Students will conduct research involving both areas, and upon graduating will be qualified to deal with the increasing number of important nutritional problems that require epidemiological investigation. The second new doctoral program will focus on the economics of agriculture, food, and nutrition. Students will take courses in the School of Public Health and in the Economics Department of the Graduate School of Arts and Sciences. Although economics will form the core of the program, a multidisciplinary awareness of the complex nature of nutritional problems will receive high priority. Because these two proposed programs are still in a tentative stage of development, interested individuals should contact the Department of Nutrition before applying.

Nutrition 201a,b. Selected Topics in Public Health Nutrition

Lectures. *One 2-hour session each week. 2.5 units.* Dr. el Lozy, Dr. Gershoff.

The course deals with selected topics in human nutrition and the application of nutrition programs to public health. The course is concerned with nutrition problems of developing countries, such as nutritional deficiency diseases, famine, and the relationship of food and nutrition programs to socioeconomic development. It is also concerned with nutrition problems in industrialized countries, such as obesity, nutrition and cardiovascular disease, food safety, and nutrition programs in the United States.

Nutrition 202a,b. Public Health Nutrition

Lectures, discussion. *Two 2-hour sessions each week. 5 units.* Dr. Hegsted.

This course deals with major nutrition-related health problems. These range from coronary heart disease and other diseases primarily related to over-consumption in affluent populations to nutrient deficiencies in disadvantaged groups. Consideration is given to use and interpretation of food consumption data and the epidemiologic, biochemical, clinical, anthropometric, and experimental animal data relevant to defining satisfactory diets. Intervention methodologies are discussed and evaluated.

Nutrition 203c,d. Nutrition Policy Formation and Program Operation

Lectures, discussion. *Two 2-hour sessions each week. 5 units.* Dr. Austin.

This course deals with the formation of food and nutrition policies and the operation of nutrition intervention programs aimed at the major nutritional problems in the United States and in the developing nations. The course employs a multidisciplinary and case study approach to develop

skills in analyzing and formulating nutrition policies and plans, and to sharpen problem-solving and decision-making capacities regarding nutrition program operation.

Prerequisite: Nutrition 202a,b or permission of the instructor.

Nutrition 204a,b,c,d. Departmental Seminar

Seminars. *Two 1-hour sessions each week. 4 units.* Dr. Thenen, Dr. Timmer.

This course is designed to teach skills required for oral presentations appropriate to the student's program. Students will attend and present seminars reviewing current publications related to nutrition. Topics include biochemical, clinical, behavioral, public health, policy, and management aspects of nutrition.

Nutrition 205a,b; 205c,d. Biochemistry and Physiology of Nutrition

Lectures. *Two 2-hour sessions each week. 5 units each semester.* Dr. Hayes, Dr. Huber, Dr. el Lozy, Dr. Nicolosi, Dr. Thenen.

The biochemistry and physiology of carbohydrates, fat, protein, vitamin, and mineral metabolism are integrated from the nutritional perspective. The course is offered in the first semester and repeated in the second semester, but with a different emphasis. The first semester introduces the subject matter to students without prior background in biology or nutrition; the second semester provides an in-depth analysis for students with a major interest in nutritional biochemistry.

Prerequisite: Course in biochemistry (second semester only). Enrollment in either semester is subject to the approval of the instructors. Students should decide whether to take the course in the first or the second semester on the basis of their prior background, as indicated in the course description.

Nutrition 206c,d. Laboratory and Animal Research Techniques

Lectures, demonstrations. *One 3-hour session plus 2 additional hours each week. 5 units. Reduced credit may be arranged for students not majoring in nutrition.* Dr. Geyer, Dr. Antoniades, Dr. Nicolosi, Staff of the Department.

By means of discussions, laboratory work, and tutorial instruction this course affords the opportunity to learn the principles and practice of modern experimental animal and laboratory research techniques. The schedule is so arranged as to allow the student to simultaneously participate in a variety of ongoing research projects involving animals and/or mammalian cell cultures, and to conduct instrumental and noninstrumental laboratory procedures.

Maternal and Child Health and Nutrition 207c,d. Nutrition in Child Growth and Development

Lectures, discussions. *One 2-hour session each week. 2.5 units.* Dr. Dwyer, Visiting Lecturers.

(Course is described under Department of Health Services.)

Nutrition 208c,d. Nutritional Aspects of Human Disease

Lectures, case presentations, discussions. *One 2-hour session each week. 2.5 units.* Dr. Herrera-Acena, Dr. el Lozy, Mrs. Witschi, Staff of the Nutrition and Dietetics Department, Peter Bent Brigham Hospital.

This course reviews the role of diet in the causation and management of clinical obesity, diabetes mellitus, coronary artery disease, anemia, and developmental retardation. Early detection and prevention of these nutrition-related disorders will also be considered.

Nutrition 209a,b. Food Science and Nutrition

Lectures, discussions. *Two 1-hour sessions each week. 2.5 units.* Mrs. Witschi, Dr. Samonds, Staff of the Department.

This course deals with nutrition in terms of the foods which supply mankind's nutrient needs, their composition and physical properties, and the positive and negative effects on nutrient qualities of food of genetic manipulation, agricultural practice, processing, storage, and cooking. The historical development of food technology, including methods of preservation and sanitation, is related to current methods employed in both developing and industrialized countries.

Nutrition 300a,b,c,d,e. Tutorial Programs

Time and credit to be arranged.

Individual work, under direction, may be arranged for students at the master's level. This may include laboratory studies or projects in applied nutrition.

Nutrition 350. Research

Time and credit to be arranged.

Facilities are available for students at the doctoral level to do advanced work in nutrition along the lines of fundamental research or applied nutrition in public health and medicine. Areas currently receiving intensive and comprehensive study in the Department are as follows:

Lipid metabolism in human and animal cells, isolated organ nutrition and metabolism, parenteral nutrition, and blood replacement preparations (*Dr. Geyer*).

The nutritive value of proteins and protein requirements; dietary effects on the metabolism of cholesterol in animals and man; the influence of

diet on the metabolism of adipose tissue; nutritional requirements for calcium and for bone formation (*Dr. Hegsted*).

Coronary artery disease; etiology of sudden death; derangements of the heart beat; exercise physiology; electrolyte metabolism (*Dr. Lown*).

The effect of nutrition and other environmental factors on the etiology of heart disease in man; nutrition education, particularly of the public; fluoride in human nutrition as a preventive for tooth decay and osteoporosis (*Dr. Stare*).

Measuring and predicting the nutritional impact of government policies, particularly non-nutrition policies; the formation and evolution of rice policies in Asia; rural development (*Dr. Timmer*).

Protein isolation and characterization; hormone biochemistry and metabolism (*Dr. Antoniades*).

Nutritional pathology with specific interest in diet and disorders of lipid and lipoprotein metabolism, particularly atherogenesis in non-human primates (*Dr. Hayes*).

The role of nutrition and other environmental factors in the etiology and management of diabetes mellitus; the relationship of malnutrition to physical and cognitive development (*Dr. Herrera-Acena*).

Anthropometric methods in the assessment of nutritional state; mathematical models of the growth of normal and malnourished humans and animals (*Dr. el Lozy*).

The epidemiology of malnutrition, physical growth deficit, and cognitive retardations (*Dr. Mora*).

Metabolic aspects of obesity and diabetes; influence of folic acid on reproduction, hemopoiesis and disease resistance; biochemical lesions in vitamin B_{12} deficiency (*Dr. Thenen*).

Influence of neural factors, psychologic conditioning, and myocardial ischemia on susceptibility to ventricular arrhythmias and sudden death (*Dr. Verrier*).

Computer-based interactive dietary history, analysis, and counseling programs (*Mrs. Witschi*).

Nutrition policy formation, nutrition intervention design, and the developmental and managerial aspects of food systems within the United States and in developing countries (*Dr. Austin*).

Trace mineral metabolism (*Dr. Huber*).

Admission is limited and is subject to the approval of the instructor.

The following courses, offered in the Faculty of Arts and Sciences, may be of particular interest to students of nutrition.

Economics 1261. The World Food System
Half course *(fall term). Tu., Th., at 11.* Timmer.

Dd-102. Dudley House Seminar: Blood
One two-hour session each week. *4 units.* Antoniades.

DEPARTMENT OF PHYSIOLOGY

James L. Whittenberger, S.B., M.D., A.M. (hon.), James Stevens Simmons Professor of Public Health, Professor of Physiology, and Head of the Department

Faculty: Professors Ferris, Hornig, Little, Mead, Peters, Roberts, and Tashjian; Associate Professors Amdur, Brain, Hoppin, D. E. Leith, Sorokin, and Wegman; Assistant Professors Boden, Butler, Dawson, Eisenstadt, Fine, Jaeger, Kennedy, Richardson, Smith, Valberg, and Williams; Lecturers R. Murphy, Snook, and Spencer

Teaching and Research Staff: Lecturers R. Feldman and Storm; Research Associates H. Feldman, Gold, Grant, Henson, Inbar, Lewis, Loring, Nagasawa, Robertson, and Voelkel; Consultants McGandy and S. Murphy; Assistant Vetrovs

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The Department of Physiology has interests which include physiology as a basic medical science. The Department's concerns, however, extend beyond pure physiology to encompass a broad spectrum of environmental and occupational health problems. The biologic effects of air pollutants, of pesticides and plastics, of radiation, and of occupational exposures are typical problems that have been central to the Department's interests. Such broad problems require the insights of many specialties, and the personnel of the Department reflect this. The staff includes physicians, physiologists, engineers, toxicologists, and specialists in radiobiology and occupational health. Students and research fellows come with similarly varied backgrounds.

A major objective of the Department is to provide students with basic information on the relationship of man to his physical and chemical environment. The course Environmental Health Interdepartmental 201a, 201b introduces fundamental concepts regarding the measurement of both the quality of the environment and its impact on man. These concepts are examined in detail in specialized courses such as Principles of Toxicology, Radiation Biology, and Basic Problems in Occupational Health and Industrial Environments (Environmental Health Interdepartmental 251c,d). Specific research projects of members of the Department offer students an opportunity to gain experience in, and to develop a capacity for, critical evaluation of research methods. Qualified individuals may enroll in a program leading to a doctoral degree.

The research programs include topics such as cellular effects of ionizing radiation, mechanisms of carcinogenesis and mutagenesis, inhalation toxicology, monomer metabolism, plastics pyrolysis product toxicity, comparative respiratory physiology, the deposition and clearance of particles in the respiratory tract, and epidemiologic studies of working populations exposed to various toxic materials. Other research areas are the mechanical properties

of lungs and chest wall, development of pulmonary function tests and testing equipment, and applications of these methods to the study of respiratory disease in occupational and community environments.

Physiology 203a,b. Human Physiology

Lectures, conferences, demonstrations. *Three 2-hour sessions each week. 5 units.* Dr. Leith, Staff of the Department.

Students lacking a background in biology are offered an intensive introduction to biological principles and to the physiology of cells, organ systems, and organisms. Some pathophysiology and a number of laboratory exercises are included.

Prerequisites: College courses in physics, chemistry, and mathematics, or permission of the instructor.

Physiology 205c,d. Principles of Toxicology

Lectures, demonstrations. *Two 2-hour sessions each week. 5 units.* Dr. Jaeger, Dr. Tashjian, Guest Lecturers.

Toxicology is the study of the injurious effects of chemicals that enter the organism without purposeful intent. This course presents principles of toxicology using a systematic approach, as well as specific case examples. Topics include mechanisms of injury at the molecular, cellular, organ system, and organismal levels. Modern methods for detecting, evaluating, analyzing, and combating the toxic effects of chemicals are emphasized.

Prerequisites: Organic chemistry, biological chemistry, and mammalian physiology, or equivalents. If prerequisites have not been satisfied, consultation with the instructors is advised.

Physiology 206a,b. Pulmonary Cell Biology

Lectures. *One 2-hour session each week.*

Laboratory. *To be arranged. 5 units.* Dr. Sorokin, Dr. Brain, Staff of the Department, Guest Lecturers.

Given alternate years; to be given in 1979-80.

This course surveys pulmonary structure and function, trachea to alveolus, from the viewpoint of cell biology. It examines biological properties of the more than forty cell types present and considers how cell and tissue functions are integrated to provide for respiration, defense against airborne infection, and other metabolic functions. Knowledge gained in this course will help prepare the student for research on the lungs and help give insight into pulmonary disease.

Prerequisites: College-level course in histology or cell biology and permission of the instructors.

Physiology 207c,d. Radiation Biology

Lectures. *Three 1-hour sessions each week. 4 units.* Dr. Little.

This course is divided into two parts: cellular and mammalian radiobiology. The first includes radiation chemistry; cell survival, transformation, and aging; chromosomal effects; UV-photobiology; and cellular and molecular repair processes. The second covers effects of radiation in man and characteristics of internal and external human exposure. The biologic basis of the acute radiation syndrome, and the human epidemiologic data for radiation carcinogenesis, are emphasized.

Prerequisite: Physiology 203a,b or college-level course in biology.

Physiology 208a,b,c,d. Seminar in Toxicology

Lectures, seminars. *One 1-hour session each week. 2 units (0.5 units each period).* Dr. Jaeger, Dr. Amdur.

This course consists of seminars and discussion of topics in basic research, current literature reviews, applied problem areas, and legislative matters in toxicology. Topic themes vary from year to year; students concentrating in toxicology are expected to register each year. Students who wish to offer toxicology as an area for doctoral examinations should register at least one year in this course.

Enrollment is subject to the approval of the instructor.

Physiology 209a,b. Molecular and Cellular Processes in Radiobiology

Lectures. *One 2-hour session each week.*

Laboratory. *Individual work to be arranged. 5 units.* Dr. Williams.

The effects of radiations on mammalian cells in culture are studied in detail with special emphasis on survival theory analysis, nucleic acid metabolism, synergism and antagonism between physical and chemical agents at the molecular level, and the role of molecular repair in survival. Students are given original problems in radiobiology to solve using cultured mammalian cells.

Prerequisite: Physiology 207c,d or permission of the instructor.

Physiology 210a,b. Advanced Toxicology

Lectures, discussion. *One 2-hour session each week.*

Laboratory, conferences. *4 hours each week, to be arranged. 5 units.* Dr. Jaeger, Dr. Amdur.

The purpose of this course is to provide an in-depth understanding of the biological and chemical mechanisms of action of toxic substances and an introduction to laboratory methods for research in toxicology. The course is primarily intended for students who plan careers of research in toxicology or other disciplines concerned with chemical-biological interactions.

Prerequisite: Previous completion of or concurrent registration in Physiology 205c,d, and permission of the instructor. This course will be given only if registration warrants.

Physiology 300. Tutorial Programs

Time and credit to be arranged.

Opportunities are provided for tutorial work in the fields of respiratory physiology, toxicology, occupational medicine, and radiobiology.

Physiology 350. Research

Doctoral candidates may undertake laboratory or field research under the direction of faculty members working in the following areas:

Occupational health (*Dr. Peters, Dr. Wegman, Dr. Fine*).
Radiobiology and experimental carcinogenesis (*Dr. Little, Dr. Williams, Dr. Kennedy*).
Respiratory physiology (*Dr. Mead, Dr. Leith, Dr. Hoppin, Dr. Dawson*).
Toxicology and respiratory defense mechanisms (*Dr. Amdur, Dr. Brain, Dr. Jaeger, Dr. Sorokin*).
Community air pollution (*Dr. Ferris*).

The following course, which is offered at the Massachusetts Institute of Technology, is open to properly qualified students from the School of Public Health.

M.I.T. 3.575J. Technology, Law, and the Working Environment

Non-unit graduate course. *Fall term, M., 7-10 p.m.* Ashford.

DEPARTMENT OF POPULATION SCIENCES

Joe D. Wray, A.B., M.D., M.P.H., Visiting Professor of International Health and Maternal and Child Health and Acting Head of the Department

Faculty: Professors and Visiting Professors Alonso, Dyck, Keyfitz, Levins, Lewontin, and Salhanick; Associate Professors W. Berggren, Masnick, and Repetto; Assistant Professors G. Berggren and Ewbank; Senior Lecturer Wyon; Lecturer Frisch

Teaching and Research Staff: Lecturers and Visiting Lecturers Guerrero, Kline, D. Korten, F. Korten, McIntosh, Morehead, Plank, and Strauss; Research Associates Holtrop, Morales, Uzgiris, and Whipple; Consultants Gamble, Goldstein, and C. Thomas

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Acting under the conviction that rapid population growth was thwarting efforts to provide better housing, education, nutrition, health services, and medical care, and that the disparity between rates of population increase and rates of development of human and economic resources is a crucial problem confronting society, the School of Public Health established the Department of Demography and Human Ecology in 1962 (renamed the Department of Population Sciences in 1969) and the Center for Population Studies in 1964. As the view of the role of population change in health and welfare has matured, increasing attention has been given to questions of the broader interrelations between population structure, health and welfare, and social change.

Faculty affiliated with the Department are specialists in demography, ethics, epidemiology, economics, sociology, ecology, genetics, business, psychology, and medicine. The formal courses and the tutorial instruction of the Department are planned to prepare students for effective participation in population programs as administrators, research workers, or educators. Programs of study are offered in the following areas: (a) population, health, and nutrition; (b) the design, management, and evaluation of population programs; (c) the analysis of complex ecological systems; (d) demographic analyses; and (e) reproductive biomedicine.

The Department participates in the School's Master and Doctor of Science and Master and Doctor of Public Health programs. (A description of the programs leading to the degrees of Master and Doctor of Science in Population Sciences may be found in the section entitled "Admission and Degree Requirements and Academic Programs." General descriptions of the Master and Doctor of Public Health programs are also included in that section.)

The Department Office has information on courses related to population which are available elsewhere in the University.

Population Sciences 130a,b. The American Household in Demographic Perspective (Sociology 130)

Lectures. *Two 1-hour sessions each week. 5 units.* Dr. Masnick.

This course examines, in the context of longer historical trends, the recent dramatic changes in family structure brought about by changes in patterns of household formation, marriage, separation, divorce, remarriage, childbearing, female labor force participation, and mortality. Implications for elements of the social order receive emphasis, including general integration of age structure, characteristics of the labor force, familial support in health care, and the housing market.

Population Sciences 185a,b. Applied Mathematical Demography (Sociology 185)

Lectures. *Two 1½-hour sessions each week. 5 units.* Dr. Keyfitz.

Topics covered by this course include probabilities of survival and of childbearing; the general one-sex model and the stable special case; parity and interbirth intervals; cohorts and periods; and extension to two sexes and to changing rates of birth and death. Also covered are application to population prediction, inferring birth rates from censuses, occupational mobility, migration, kinship, and effects of birth control.

Prerequisite: A year of calculus.

Population Sciences 190c,d. Ecology and the Spatial Distribution of Population (Sociology 190)

Lectures, tutorials. *Two 1-hour lectures and one 1-hour tutorial session each week. 5 units.* Dr. Keyfitz.

Not given in 1978-79.

Topics covered by this course include the environment and its population-carrying capacity as a function of technology; limits of growth set by raw material shortages and pollution; agriculture and transport as determinants of population distribution; poles of development; territoriality, nationhood, and population growth; and the dynamics of migration.

Population Sciences 191a,b. The Spatial Aspects of Societies (Sociology 191)

Lectures. *Two 1-hour sessions each week. 5 units.* Dr. Alonso.

The course stresses the interaction of societies and their geography, focusing primarily on the historic and current development of the United States. Consideration is given to technology, institutions, ideology, health, the economy, and other factors influencing the growth and shape of cities, their relations to each other and to rural areas.

Population Sciences 195a,b. The Biological Determinants of Fecundity, Environmental Factors, and Population Growth

Lectures. *One 2-hour session each week. 2.5 units.* Dr. Frisch.

This course deals with the direct effect of environmental factors such as nutrition on population growth, through the effects on age of menarche, age of male maturation, length of adolescent subfertility, lactational amenorrhea, pregnancy wastage, and age of menopause. Contemporary and historical data on these biological factors from different cultures will be considered, as well as their interactions with social customs.

Population Sciences 200a,b. Introduction to Population Sciences

Lectures. *Two 1-hour sessions each week. 2.5 units.* Dr. Ewbank, Staff of the Department.

The course reviews the basic interrelationships among fertility, mortality, and migration. Their interaction with social, cultural, and economic characteristics of societies is discussed for countries at each stage of the demographic transition, i.e., for both developed and developing countries. The course then introduces basic demographic concepts and methods, including age-sex pyramids, life tables, demographic rates, and kinds of surveys needed for collection of data.

Population Sciences 201a,b. Introductory Seminar on Population Sciences

Seminars. *One 2-hour session each week. 2.5 units.* Dr. Ewbank, Staff of the Department.

This seminar supplements the introduction to population sciences presented in Population Sciences 200a,b. Most students will be concurrently enrolled in 200a,b. Topics include: basic physiology of human reproduction, contraceptive methods, population ethics, design of population programs, relationship between population growth and economic development, and contraceptive use in the United States. Several short papers will be required.

Prerequisite: Population Sciences 200a,b, taken previously or concurrently.

Population Sciences 202c,d. Departmental Seminar

Seminars. *One 2-hour session each week. 2.5 units.* Dr. Wyon, Staff of the Department.

This course is oriented towards health and population problems of communities. Each student selects a community and an appropriate health or population problem. He presents a critical survey of the relevant literature and a project design, to amplify understanding of the relative frequency of the selected problem in relation to other health or population problems of the community, and to increase or test the available knowledge of causes of the problem.

Population Sciences 203c. Basic Demographic Methods

Seminars. *Two 2-hour sessions each week. 2.5 units.* Dr. Masnick, Dr. Ewbank.

This course introduces the conceptual tools that are basic to any demographic analysis. Topics include fertility rates, life tables, population projection, analysis of age structures, and the relationship between period and cohort data. It is expected that most students will continue on to Population Sciences 205d and/or Population Sciences 206d.

Population Sciences 204c,d. Biological Basis for Fertility Control

Lectures. *Two 1-hour sessions each week, with a third hour at the discretion of the instructor.*

Laboratory. *Six 2-hour sessions, to be arranged. 5 units.* Dr. Salhanick, Staff of the Department.

This course presents the fundamental physiology and biochemistry related to known and potential methods of family planning. Topics covered include the biosynthesis, secretion, effects, and modes of action of the gonadal and gonadotropic hormones; the relationship of the natural steroid hormones to synthetic analogues is also discussed. Laboratory sessions include demonstrations of a family planning clinic, an infertility unit, and procedures for sterilization and pregnancy termination.

Prerequisites: Population Sciences 200a,b and appropriate science background.

Population Sciences 205d. Population Analysis in Developing Countries

Lectures. *Two 2-hour sessions each week. 2.5 units.* Dr. Ewbank.

This course presents the basic methods for demographic analysis of populations in developing countries. This includes techniques for estimating fertility and mortality rates in the absence of reliable vital statistics; survey approaches to intensive study of small areas, including analysis of birth intervals, mortality patterns, and migration streams; and an introduction to the measurement of the impact of family planning and health programs.

Prerequisite: Population Sciences 203c.

Population Sciences 206d. Population Analysis in the United States

Lectures. *Two 1½-hour sessions each week. 2.5 units.* Dr. Masnick.

This course introduces the data and techniques for population analysis as a part of planning and evaluation in health and social service professions. Different population units from region to household receive attention, with focus on dynamic populations for evaluation of consequences of rapid change in population structure for service delivery. Cases include

hospital bed needs, family health centers, health care and housing for the elderly, and other relevant topics.

Prerequisite: Population Sciences 203c.

Population Sciences 209a,b. Foundations of Agricultural Sciences (Biology 195)

Lectures, seminars. *Two 1½-hour sessions each week. 5 units.* Dr. Levins.

This course examines patterns of world food production as it develops from the interaction of social and biological systems: evolution of agro-ecosystems, principles of plant growth and productivity, pests and diseases, ecology of farming systems, consequences of technical choices, issues of agricultural change, and research strategies.

Prerequisite: Course in biology or permission of the instructor.

Population Sciences 209c,d. Population Biology

Lectures. *Two 1½-hour sessions each week. 5 units.* Dr. Lewontin, Dr. Levins.

This course approaches population studies from a general biological standpoint. It attempts to integrate population and community ecology, population genetics, and biogeography. Topics include: the structure of the environment in space and time and its interaction with organisms, simple single-species growth dynamics, age-dependent demography, two-species interactions, multiple-species community dynamics, evolution of the niche, elements of population genetics, and topics in biogeography.

Prerequisites: College courses in calculus and biology.

Population Sciences 212c,d. An Economic Approach to Population Policy

Lectures. *One 2-hour session each week, with a third hour at the discretion of the instructor. 5 units.* Dr. Repetto.

This course presents the economics relevant to the formulation and evaluation of population policies in developing countries and surveys knowledge about the effectiveness of intervention strategies. It covers welfare economics of population policies; interactions between fertility and economic development; the impact on population growth of policies to affect incomes, education, survivorship, old-age security, and related variables, as well as conventional family planning programs.

Prerequisites: Population Sciences 200a,b and Health Services Administration 252a,b, or equivalent.

Population Sciences 216c,d. Comparative Analysis of Public Policies in Developing Countries (Government 211)

Lectures. *One 2-hour session each week. 5 units.* Dr. John Montgomery

(Professor of Public Administration), Dr. Joel Migdal (Associate Professor of Government).

This course examines patterns of policy making across cultures and issue areas, including interactions between policies and social contexts. It surveys Third World policies for dealing with such problems as population (fertility and migration); malnutrition; land reform; and management of large-scale irrigation systems. It applies the policy sciences approach to the formulation and implementation of large-scale programs of public intervention in social processes.

Population Sciences 217b. Introduction to Community Diagnosis of Birth and Death Rates in Developing Countries

Lectures, discussions. *One 2-hour session each week. 1.25 units.* Dr. Wyon.

This course helps students distinguish within communities those kinds of persons at high risk of serious illness, death, and unwanted births. It uses data from studies at national and local levels to trace underlying causes of these events as the basis for designing feasible, effective, and simple preventive measures. This course therefore provides foundations for Population Sciences 202c,d and for other health and population courses considering policies and programs.

Prerequisites: Introductory courses in biostatistics, epidemiology, and (preferably) population sciences.

Population Sciences and Health Services Administration 235c,d. The Design and Management of Population Programs

Case discussions, seminars. *Two 2-hour sessions each week. 5 units.* Dr. G. Berggren, Dr. Wray, Dr. Ewbank, Dr. Wyon, Dr. Hazel Denton (Assistant Professor of Business Administration, Harvard Business School), Staff of the Department.

This course addresses, from a managerial perspective, the problems of developing and implementing population programs in Third World nations. These problems are examined from the level of the community, the program manager, and the national development planner. Topics are covered primarily through case studies based on family planning, health, nutrition, and rural development programs. Stress is placed on programs involving rural community members in program implementation.

Enrollment is subject to the approval of the instructors. Preference is given to persons with Third World experience and professional commitment to Third World social development.

Population Sciences 285c,d. Applied Mathematical Demography Seminar (Sociology 285)

Seminars. *One 2-hour session each week. 5 units.* Dr. Keyfitz.

This course consists of research on the topics of Population Sciences 185a,b.

Enrollment is subject to approval of the instructor.

Population Sciences 286c,d. Formal Models of Movement (Sociology 235)

Seminars. *One 2-hour session each week; additional individual consultations to be arranged. 5 units.* Dr. Alonso.

This course reviews a broad variety of models of movement of populations and other types of movement, from the social sciences and possibly from the natural sciences. A detailed examination of the structure, assumptions, and uses of these models is presented. An effort is made to place them within a common theoretical structure and to compare their assumptions and implications.

Population Sciences 300. Tutorial Programs

Time and credit to be arranged.

Students at the master's level may make arrangements for tutorial work and special reading on topics related to population problems. There may be an opportunity to consider the design of studies, programs, or analysis of data.

Population Sciences 330e. Field Visits

One-week period between fall and spring terms or one-week period between third and fourth quarters. 1 unit.

Students concentrating in the Department of Population Sciences may participate in visits to organizations currently active in demographic studies, community education, and research and service in fertility control.

Additional Field Study

At the end of the academic year, a field visit may be arranged for students majoring in the Department of Population Sciences.

Participation is limited to 10 students.

Population Sciences 350-355. Research

Time and credit to be arranged.

Candidates for doctoral degrees may undertake research in the Department or may integrate research in population sciences with a doctoral program in another department or at the Center for Population Studies.

Members of the Department and of the Center for Population Studies are currently engaged in research in the following areas:

350 Topics in field studies and programs (*Dr. Wyon, Dr. Plank, Dr. Guerrero, Dr. Berggren*).

351 Topics in biomedicine and reproductive physiology (*Dr. Salhanick*).

352 Topics in demography (*Dr. Keyfitz*).

353 Topics in population ethics (*Dr. Dyck, Dr. Potter*).

354 Topics in population economics (*Dr. Repetto*).

355 Topics in complex systems (*Dr. Levins*).

The following courses, offered at other faculties of Harvard University, are among those that may be of particular interest to students of population sciences. They are open to properly qualified students from the School of Public Health.

Ethics 284. Seminar: Human Rights, Population Policy, and Natural Law Theory

Spring term. *One 2-hour session each week. 5 units.* Dyck. (Offered at Harvard Divinity School).

Sociology 103. The Material Basis of Society

Half course *(spring term). Two 1-hour sessions, to be arranged.* Keyfitz. (Offered in the Faculty of Arts and Sciences).

DEPARTMENT OF SANITARY ENGINEERING

Harold A. Thomas, Jr., S.B., S.M., S.D., Gordon McKay Professor of Civil and Sanitary Engineering

J. Carrell Morris, S.B., A.M., Ph.D., A.M. (hon.), Gordon McKay Professor of Sanitary Chemistry

Joseph J. Harrington, B.C.E., A.M., Ph.D., Professor of Environmental Health Engineering in the Faculty of Public Health and Gordon McKay Professor of Environmental Engineering in the Faculty of Arts and Sciences

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The courses in which members of this Department participate in the School of Public Health are listed on page 73 (Environmental Health Interdepartmental 201a, 201b) and on page 59 (Interdepartmental 215c,d).

The courses of instruction listed below are offered in the Division of Applied Sciences of the Graduate School of Arts and Sciences. Graduates of engineering colleges or scientific schools may be admitted to the Division as candidates for the degree of Master of Science or Doctor of Philosophy. They may elect appropriate courses in the School of Public Health as part of the program for these degrees. Further information can be obtained by writing to the Committee on Admissions, Graduate School of Arts and Sciences, Holyoke Center, 75 Mt. Auburn Street, Cambridge, Massachusetts 02138.

The following courses offered in the Division are open to properly qualified students from the School of Public Health:

Engineering Sciences 171. Chemistry of the Aqueous Environment

Half course (*fall term*). *M., W., F., at 11.* Professors McElroy and Wofsy. To be omitted in 1979-80.

Chemical principles applicable to environmental science and engineering. Emphasis on pH, complex formation, and solubility in multicomponent systems. Principles of analytical chemistry and their application to analysis of water. Sources, occurrence, and chemical reactions of important constituents in natural waters.

Prerequisite: Chemistry 10 or equivalent.

Engineering Sciences 173. Introduction to Environmental Microbiology

Half course (*spring term*). *M., W., (F.), at 9, and laboratory hours to be arranged.* Professor Mitchell.

Introduction to the ecology of microorganisms. Emphasis on microorganisms as functioning members of ecosystems. Critical examination of the role of microorganisms in water pollution, water-borne diseases, biological control, and water purification.

Prerequisite: Biology 1 or Biology 19, Mathematics 1.

Engineering Sciences 174. Concepts and Methods in Microbial Ecology

Half course (*fall term*). *M., W., (F.), at 9, and laboratory hours to be arranged.* Professor Ducklow.

To be omitted in 1979-80.

An analytical examination of concepts and research methods related to four fundamental questions in microbial ecology: How many microorganisms exist in different ecosystems? What are their activities *in situ*? What is the nature of microbial communities? What biological interrelationships exist among microorganisms? Four open-ended laboratories will assist in answering these questions.

Prerequisites: Mathematics 1; Biology 19 or Biology 154; Biology 12 or Engineering Sciences 173.

Engineering 250a. Design of Water Resource Systems

Half course (*fall term*). *Tu., Th., 10-12.* Professor Thomas.

Principles of engineering and economic analysis applied to water resource systems. Functional design of comprehensive management systems for collection, storage, conveyance, treatment, and distribution of water. Uses techniques of operations research and econometrics to develop methods for planning integrated systems of dams, reservoirs, canals, pipelines and networks, pumps, and treatment plants.

Prerequisites: Applied Mathematics 105a; Engineering Sciences 121, 123 or equivalents.

Engineering 250b. Design of Water Resource Systems

Half course (*spring term*). *Tu., Th., 9:30-11.* Professor Thomas.

Continuation of Engineering 250a, with emphasis on nonlinear systems and systems with stochastic components. Application to multiunit systems for industrial, municipal, and agricultural water supply, navigation, hydropower, conservation of wildlife, and the preservation and enhancement of the environment.

Prerequisites: Engineering 250a; Statistics 190 or equivalent desirable.

Engineering 253. Stochastic Processes in Environmental Engineering

Half course (*fall term*). *M., W., F., at 9.* Professor Fiering.

To be given in 1978-79; alternates yearly with Engineering 254.

Theory and applications of stochastic processes and time series for environmental problems, including hydrology, birth-death processes, hazard perception, storage systems, queues, Markov chains, multivariate techniques, and spectral analysis.

Prerequisite: Engineering 250a, Engineering Sciences 118, or equivalent.

Engineering 254. Mathematical Programming for Large Systems

Half course (*fall term*). *M., W., F., at 9.* Professor Rogers.

To be given in 1979-80; alternates yearly with Engineering 253.

Application of optimizing theory to large environmental control systems. Practical problems involved in formulation and computation of mathematical programming models for these systems. Decomposition, multi-level and multi-objective planning, stochastic and mixed integer programming models.

Prerequisite: Engineering Sciences 119 or equivalent.

Engineering 257. Seminar: Models for Environmental Systems Planning

Half course (*throughout the year*). *Hours to be arranged.* Staff of the Division.

Critical evaluation of current systems applications; biology and chemistry in environmental science, with emphasis on models for the analysis of water quality standards, optimality, and resilience in water-resource systems. Papers and presentations are required. Students intending to enroll should meet with Professor Butler to arrange scheduling before study cards are due.

Engineering 270. Engineering Systems for Environmental Control

Half course (*spring term*). *M., W., F., at 10.* Professor Harrington.

Provision of urban water; engineering aspects of the collection and disposal of spent water and solid wastes; significant interchanges between the gaseous, liquid, and solid phases of the environment; geographic interchanges; time-dependent developments. Data collection and processing for monitoring and control; maintenance and operation of pollution control systems.

Prerequisite: Engineering Sciences 123 or permission of instructor.

Note: To be offered if 10 or more students enroll.

Engineering 272. Water Quality and Its Management

Half course (*spring term*). *Tu., Th., 11-12:30.* Professor Morris.

To be given in 1979-80.

Nature, sources, and effects of inorganic and organic impurities in natural waters. Water quality standards. Effects of contaminating and polluting discharges on water quality. Natural purification of surface waters. Chemical and biochemical transformations in lakes and rivers.

Prerequisites: Engineering Sciences 171 and 173.

Engineering 273. Water Pollution Microbiology

Half course (*fall term*). *M., W., 2-3:30.* Professor Mitchell.

To be omitted in 1979-80.

Advanced discussion of the role of microorganisms as both pollutants and

purifying agents. Particular attention to ecological approaches to pollution control. Eutrophication, microbial imbalances, pesticides, stream purification, and a critical discussion of current waste treatment methods.

Prerequisite: Engineering Sciences 173 or equivalent.

Engineering 274. Chemical Models of Natural and Polluted Waters

Half course (*spring term*). *Tu., Th., 1-2:30.* Professor Butler.

To be omitted in 1979-80.

Chemical aspects of aqueous environmental systems. Mathematical models include thermodynamic, kinetic, biological, and hydrodynamic processes. Applications to water quality management, pollution control, limnology, oceanography, and geology.

Prerequisites: Physical chemistry (e.g., Chemistry 11, Engineering Sciences 171) and some experience in computer programming.

Engineering 276. Treatment of Water Supplies and Wastewaters

Half course (*spring term*). *Tu., Th., 11-12:30.* Professor Morris.

To be given in 1979-80.

Quality standards for water supplies. Processing of natural water for municipal use, including coagulation, softening, deferrization, disinfection, adsorption, and demineralization. Physical, chemical, and biological treatment of wastewaters, including "advanced" methods.

Prerequisite: Engineering Sciences 171 or permission of instructor.

Engineering 278. Rate Processes

Half course (*fall term*). *M., W., F., at 11.* Professor Morris.

To be given in 1979-80.

Kinetics of physical and chemical reactions, with emphasis on aqueous systems. Kinetic data and their interpretation. Mechanisms of inorganic reactions. Reaction dynamics in environmental engineering.

Prerequisite: Engineering Sciences 171 or equivalent.

DEPARTMENT OF TROPICAL PUBLIC HEALTH

Thomas H. Weller, A.B., S.M., M.D., LL.D., Richard Pearson Strong Professor of Tropical Public Health, Director of the Center for the Prevention of Infectious Diseases, and Head of the Department

Faculty: Professor Chernin; Associate Professors W. Berggren, Michelson, Pan, and Spielman; Assistant Professors Boyer, Coolidge, Hoff, and Waner; Lecturer Daggy

Teaching and Research Staff: Visiting Lecturers Fendall, Foege, Hopkins, Kaiser, Mata, Moschella, Most, Mott, Neva, Popenoe, Scrimshaw, and Sencer; Research Associates Cicconi, Maguire, and Sleigh; Assistant Wheeldon

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The health problems of the tropical regions, as in all poorly sanitated areas, are predominantly of an infectious and nutritional nature. The infectious diseases are the primary concern of the Department of Tropical Public Health, with emphasis given to protozoal, helminthic, and viral entities and to relevant arthropod and molluscan intermediate hosts. Within the framework of the Center for the Prevention of Infectious Diseases, the Department of Tropical Public Health shares with the Department of Microbiology the responsibility for an integrated presentation of information on important infectious agents.

The basic course, Tropical Public Health and Microbiology 201a, is designed to provide students in the Master of Public Health program with knowledge regarding major parasitic diseases, and with factual information concerning the epidemiology and control of selected entities of public health importance.

The resolution of the health problems of tropical areas requires a multidisciplinary approach involving a considered appraisal of human resources as well as of relevant social, economic, and political factors. Thus, the student concentrating in the Department in preparation for a career in the field of international health should, in addition to departmental courses, acquire a broadened experience by elective work in other areas.

The investigative program in the Department currently deals with pathogens ranging from viruses to helminths. Studies on the *in vitro* cultivation and the physiology and immunology of a wide variety of agents are in progress. Biological investigations on the molluscan vectors of the schistosomes comprise another area of major interest. Facilities are available for the training of a limited number of students at the Doctor of Public Health or Doctor of Science level. The doctoral degree applicant should, if possible, obtain the necessary medical science background prior to enrollment. Collaborative arrangements established with institutions in the tropics provide diversified opportunities for study and research overseas.

Tropical Public Health and Microbiology 201a. Ecology, Epidemiology, and Control of Important Parasitic and Viral Diseases of Developing Areas

Lectures, seminars, demonstrations; laboratory elective. *Four 1-hour sessions and one 2-hour elective laboratory session each week. 2.5 units; 3.5 units if laboratory elected.* Dr. Weller, Staff of the Department.

This course provides an introduction to ecological and epidemiologic concepts basic to the control of infectious agents. It then considers important parasitic and viral diseases of particular significance in the developing areas of the world. Epidemiologic principles of vector-associated diseases are elucidated through study of entities such as malaria and schistosomiasis. A prior knowledge of the pathogenesis of disease produced by infectious agents is desirable.

This course complements Microbiology and Tropical Public Health 201b, and is offered under the auspices of the Center for the Prevention of Infectious Diseases.

Microbiology and Tropical Public Health 201b. Decision Making in the Control of Infectious Diseases of Public Health Importance

Lectures, workshops. *One 1-hour and two 2-hour sessions each week. 2.5 units.* Dr. Nichols, Guest Lecturers.

(Course is described under Department of Microbiology.)

Microbiology and Tropical Public Health 202b. Critiques of Current Literature on Infectious Diseases

Seminars. *One 2-hour session each week. 1 unit.* Dr. Chernin, Dr. Herrmann, Staffs of the Departments.

(Course is described under Department of Microbiology.)

Tropical Public Health 203d. Perspectives in Tropical Health

Lectures, conferences. *One 2-hour session each week. 1 unit.* Dr. Weller, Guest Lecturers.

This course provides background information on environmental, social, economic, and political factors that influence health programs in the tropics. At each session a distinguished guest lecturer covers an assigned topic, including such subjects as the development of professional education, problems of agriculture, nutrition, and water supply, and the political background of international cooperation. Each presentation is followed by informal student discussion. Enrollment is open to all students.

Tropical Public Health 204c. Laboratory Aspects of Parasitic Diseases

Lectures, seminars, laboratory exercises. *Two 3-hour sessions each week. 2.5 units.* Dr. Pan, Dr. Coolidge.

This course emphasizes laboratory methods for the study of parasitic diseases of public health importance. Students are exposed to the theory

and application of techniques essential to epidemiologic and laboratory investigation. The life cycles of several parasites are maintained and examined with respect to detection and quantification of infection, immunity, and control.

Enrollment is limited and is subject to the approval of the instructor.

Tropical Public Health 205c. Clinical and Pathologic Features of Tropical Diseases

Case presentations, clinico-pathologic conferences, demonstrations. *One 2-hour session each week. 1 unit.* Dr. Weller, Dr. Coolidge, Dr. Boyer, Dr. Franz von Lichtenberg (Professor of Pathology, Harvard Medical School), Staff of the Department.

This course, designed for students particularly interested in tropical medicine, supplements material presented in Tropical Public Health and Microbiology 201a. The emphasis is on the clinico-pathologic aspects of tropical diseases. At each session disease entities are introduced by presenting a clinical case, and pertinent clinical and pathologic features of the disease are then reviewed.

Enrollment is subject to the approval of the instructor.

Tropical Public Health 207d. Introduction to Molluscs of Public Health Importance

Conferences, laboratory and field exercises. *One 3-hour session each week. 2 units.* Dr. Michelson.

To be given in 1978-79; alternates yearly with Tropical Public Health 208d.

This is an introductory course designed to acquaint the student with the molluscs which may act either as active or passive agents for the dispersal of pathogens, toxins, or parasites which cause disease in man. Special emphasis is given to snails which serve as intermediate hosts of mammalian schistosomes. Students may study field and laboratory techniques necessary for an understanding of the taxonomy, morphology, cultivation, ecology, and control of these medically important molluscs.

Enrollment is subject to the approval of the instructor.

Tropical Public Health 208d. Epidemiology and Control of Schistosomiasis

Seminars, laboratory exercises. *One 3-hour session each week. 2 units.* Dr. Michelson, Dr. Chernin, Dr. Pan, Dr. Weller.

To be given in 1979-80; alternates yearly with Tropical Public Health 207d.

The problems posed by schistosomiasis as an expanding health hazard are presented in a series of seminars and laboratory exercises. Emphasis is given to the biology of snail vectors, to problems of assessment of significance of the disease, and to the potentials of various approaches to

control. Opportunity to become familiar with appropriate techniques is afforded in the laboratory.

Enrollment is subject to the approval of the instructor.

Tropical Public Health 209d. Introduction to Medical Entomology

Conferences, laboratory, field exercises. *One 3-hour session each week. 2 units.* Dr. Spielman.

To be given in 1979-80; alternates yearly with Tropical Public Health 210d. This course deals with the insects, ticks, and mites of public health importance. The manner in which arthropods transmit disease and the principles of vector control are discussed from ecological, physiological, and genetic points of view. Colonies of various vector species are maintained by the students to provide the basic material for study of life cycles and for arthropod identification. Laboratory and field exercises demonstrate entomological techniques currently employed by epidemiologists.

Enrollment is subject to the approval of the instructor.

Tropical Public Health 210d. Current Problems in Malariology

Seminars, laboratory exercises. *One 3-hour session each week. 2 units.* Dr. Chernin, Dr. Spielman, Dr. Weller, Staff of the Department.

To be given in 1978-79; alternates yearly with Tropical Public Health 209d. This course supplements the subject material on malaria offered in Tropical Public Health and Microbiology 201a and Tropical Public Health 204c. Particular attention is given to problems now encountered in eradication and control programs. In the laboratory, experience is provided with procedures essential to the epidemiologic investigation of malaria.

Enrollment is subject to the approval of the instructor.

Tropical Public Health and Microbiology 214c,d. Case Studies in Epidemiology of Infectious Disease

Seminars, laboratory exercises. *One 2-hour session each week. 2.5 units.* Staffs of the Departments.

This course deals with problems in the epidemiology of communicable and other acute diseases. In each session a case study is taken from an actual epidemic or other acute disease control situation, and the student is asked to assume the role of investigator and control officer. An introductory biostatistics course or equivalent is suggested as preparation for the course.

Microbiology and Tropical Public Health 216d. Sexually Transmitted Diseases

Lectures, seminars. *One 2-hour session each week. 1 unit. Additional credit may be arranged.* Dr. Nichols, Guest Lecturers.

(Course is described under Department of Microbiology.)

Microbiology and Tropical Public Health 217d. Virology

Lectures, seminars. *Three 1-hour sessions each week. 2.5 units.* Dr. Essex, Dr. Waner.

(Course is described under Department of Microbiology.)

Tropical Public Health 300a,b,c,d,e. Tutorial Programs

Laboratory exercises. *Time and credit to be arranged.*

Individual work for candidates at the master's degree level may be carried out under supervision of a member of the Department. Various parasites of medical importance are maintained and are available for studies on metabolism, host-parasite relationships, and chemotherapy. Arrangements are subject to the approval of the instructor.

Tropical Public Health 350. Research

Doctoral candidates or qualified full-time special students may undertake original investigations in the laboratory or in the field by arrangement with the Head of the Department.

Members of the Department are currently engaged in the following areas of research:

351 Tissue culture and immunological techniques as applied to problems in medical virology (*Dr. Weller, Dr. Waner*).

352 Cultivation *in vitro* of parasitic helminths, protozoa, and other invertebrates of medical importance (*Dr. Weller, Dr. Chernin, Dr. Pan*).

353 Biology, host-parasite relationships, and control of molluscan vectors of schistosomiasis and of other parasitic infections (*Dr. Chernin, Dr. Michelson, Dr. Pan*).

354 Population genetics, nutrition, and reproduction of medically important arthropods (*Dr. Spielman*).

355 Arthropod transmission of viral, protozoan, and helminthic agents (*Dr. Spielman*).

356 Immunology of schistosomiasis (*Dr. Boyer, Dr. Weller*).

357 Epidemiology of Chagas' disease and schistosomiasis in rural Brazil (*Dr. Hoff*).

358 Mechanisms of health care in rural Haiti (*Dr. Berggren*).

Officers of Instruction and Research

MEMBERS OF THE FACULTY

William Alonso, Ph.D., Richard Saltonstall Professor of Population Policy.

Mary Ochsenhirt Amdur, Ph.D., Associate Professor of Toxicology (*Physiology*); *Lecturer, Massachusetts Institute of Technology.*

Harry Nicholas Antoniades, Ph.D., Associate Professor of Biochemistry (*Nutrition*); *Senior Investigator, Blood Research Institute, Inc., Boston.*

James Edward Austin, D.B.A., Lecturer on Nutrition Policy and Programs (*Nutrition*); *Associate Professor of Business Administration, Harvard Business School.*

John Christian Bailar, III, M.D., Ph.D., Visiting Professor of Biostatistics; *Editor-in-Chief, Journal of the National Cancer Institute, NIH, Bethesda, MD.*

Colin Banks Begg, Ph.D., Assistant Professor of Biostatistics; *Statistician, Sidney Farber Cancer Institute.*

Robert Charles Benfari, M.B.A., Ph.D., S.M. in Hyg., Associate Professor of Psychology (*Behavioral Sciences*).

Gretchen Mary Berggren, M.D., S.M. in Hyg., Assistant Professor of Population Sciences.

Warren Lee Berggren, M.D., Dr.P.H., Associate Professor of Tropical Public Health and Population Sciences.

Yvonne Millicent Mahala Bishop, Ph.D., Associate Professor of Biostatistics.

Bengt Erik Bjarngard, D.Sc., Lecturer on Medical Radiation Physics (*Environmental Health Sciences*); *Associate Professor of Radiation Therapy, Harvard Medical School.*

Leslie Irvin Boden, Ph.D., Assistant Professor of Economics (*Physiology*).

Markley Holmes Boyer, M.D., D.Phil., M.P.H., Assistant Professor of Tropical Public Health.

Joseph David Brain, S.D. in Hyg., Associate Professor of Physiology.

Peter Braun, M.D., Lecturer on Public Health (*Health Services*).

William Alfred Burgess, S.M., Associate Professor of Occupational Health Engineering (*Environmental Health Sciences*); *Corporate Manager of Industrial Hygiene, Polaroid Corp.*

James Preston Butler, Ph.D., Assistant Professor of Biomathematics (*Physiology*).

Jan Cerny, M.D., Ph.D., Associate Professor of Immunology (*Microbiology*).

Gordon Chase, A.B., Lecturer on Health Policy (*Health Services*).

Eli Chernin, S.D., Professor of Tropical Public Health.

Philip Timothy Cole, M.D., Dr.P.H., Professor of Epidemiology.

Catherine Coolidge, M.D., M.P.H., Assistant Professor of Tropical Public Health.

Douglas Winslow Cooper, Ph.D., Assistant Professor of Environmental Physics (*Environmental Health Sciences*).

William George Costello, Ph.D., Assistant Professor of Biostatistics; *Statistician, Sidney Farber Cancer Institute.*

Allen Latham Cudworth, S.M. in E.E., S.D. in Hyg., Lecturer on Applied Acoustics and Environmental Health (*Environmental Health Sciences*); *Vice President of Liberty Mutual Insurance Company and Director, Hopkinton Research Center.*

William John Curran, J.D., S.M. in Hyg., Frances Glessner Lee Professor of Legal Medicine in the Faculty of Medicine and the Faculty of Public Health (*Health Services*).

Richard Henry Daggy, Ph.D., Dr.P.H., Lecturer on Tropical Public Health.

Stanley Verne Dawson, S.D. in Hyg., Assistant Professor of Environmental Health Engineering (*Physiology*).

Richard Dennis, S.M., Associate Professor of Applied Environmental Health Engineering (*Environmental Health Sciences*); *Director, Pollution Control Laboratory, G.C.A. Corporation, Bedford.*

Paul Maxmillian Densen, S.D., Professor of Community Health (*Health Services*); *Director of the Center for Community Health and Medical Care, Harvard Medical School.*

Eva Yona Deykin, M.P.H., Assistant Professor of Social Work (*Health Services*).

Margaret Elizabeth Drolette, M.P.H., Ph.D., Associate Professor of Biostatistics.

Johanna Todd Dwyer, S.D. in Hyg., Lecturer on Maternal and Child Health Nutrition (*Health Services*); *Director, Stern Nutrition Center, Tufts Medical Center.*

Arthur James Dyck, Ph.D., Mary B. Saltonstall Professor of Population Ethics; *Member of the Faculty of the Harvard Divinity School.*

Eric Eisenstadt, Ph.D., Assistant Professor of Biology (*Physiology* and *Microbiology*).

Robert Curtis Ellison, M.D., S.M. in Epid., Lecturer on Epidemiology; *Associate Professor of Pediatrics, Harvard Medical School.*

Myron Elmer Essex, D.V.M., Ph.D., Associate Professor of Virology (*Microbiology*); *Scholar of the Leukemia Society of America, Inc.*

Douglas Ewbank, Ph.D., Assistant Professor of Population Sciences.

Michael James Farmer, M.B.A., Member of the Faculty of Public Health; Associate Dean for Policy and Resources.

James Joseph Feeney, M.D., Member of the Faculty of Public Health; *Director of the Medical Area Health Service.*

Penny Hollander Feldman, Ph.D., Assistant Professor of Political Science (*Health Services*).

Benjamin Greeley Ferris, Jr., M.D., Professor of Environmental Health and Safety (*Physiology*); *Director of Environmental Health and Safety, University Health Services.*

Lawrence Jay Fine, M.D., Dr.P.H., Assistant Professor of Occupational Medicine (*Physiology*).

Harvey Vernon Fineberg, M.D., M.P.P., Assistant Professor of Health Services Administration.

Melvin William First, S.D., Professor of Environmental Health Engineering (*Environmental Health Sciences*).

Charles Edward Ovid Fraser, D.T.V.M., Ph.D., Assistant Professor of Microbiology; *Microbiologist, New England Regional Primate Research Center* (on leave 78-79).

Howard Stanley Frazier, M.D., Director of the Center for the Analysis of Health Practices and Member of the Faculty of Public Health; *Professor of Medicine, Harvard Medical School.*

Rose Epstein Frisch, Ph.D., Lecturer on Population Studies (*Population Sciences*).

Rebecca Fuhrer, Ph.D., Assistant Professor of Biostatistics and Health Services.

Richard David Gelber, Ph.D., Assistant Professor of Biostatistics; *Statistician, Sidney Farber Cancer Institute.*

Robert Pershing Geyer, Ph.D., Professor of Nutrition.

Steven Lawrence Gortmaker, Ph.D., Assistant Professor of Health Services.

Christopher Keith Grant, Ph.D., Assistant Professor of Immunology (*Microbiology*).

Robert Johns Haggerty, M.D., Professor of Public Health (Health Services and Pediatrics) in the Faculty of Public Health and the Faculty of Medicine.

James Anthony Hanley, Ph.D., Assistant Professor of Biostatistics; *Statistician, Sidney Farber Cancer Institute.*

Joseph John Harrington, Ph.D., Professor of Environmental Health Engineering (*Sanitary Engineering*) in the Faculty of Public Health and Gordon McKay Professor of Environmental Engineering in the Faculty of Arts and Sciences.

William Alan Haseltine, Ph.D., Assistant Professor of Microbiology; *Assistant Professor of Pathology, Harvard Medical School.*

Kenneth Cronise Hayes, D.V.M., Ph.D., Associate Professor of Nutrition.

D. Mark Hegsted, Ph.D., Professor of Nutrition.

Manuel Guillermo Herrera-Acena, M.D., Associate Professor of Medicine (*Nutrition*).

John Edwin Herrmann, Ph.D., Assistant Professor of Microbiology.

Howard Haym Hiatt, M.D., Dean of the Faculty of Public Health; *Professor of Medicine, Harvard Medical School.*

William Carson Hinds, S.D. in Env. H., Assistant Professor of Environmental Health Engineering (*Environmental Health Sciences*).

Rodney Hoff, M.P.H., S.D. in Tr.P.H., Assistant Professor of Tropical Public Health.

Frederic Gallatin Hoppin, Jr., M.D., Associate Professor of Physiology.

Donald Frederick Hornig, Ph.D., Professor of Chemistry in Public Health (*Physiology*); Director of Interdisciplinary Programs in Health.

William Ching-Lung Hsiao, M.P.A., Associate Professor of Economics (*Health Services*); *Member of the Faculty of Harvard Business School.*

Agnes Mayer Huber, Ph.D., Lecturer on Nutrition; *Director of Nutrition, Eunice Kennedy Shriver Center for Mental Retardation.*

George Barkley Hutchison, M.D., M.P.H., Professor of Epidemiology.

Rudolph John Jaeger, Ph.D., Assistant Professor of Toxicology (*Physiology*).

Ellen Whiteman Jones, M.P.H., Lecturer on Biostatistics; *Assistant Director, Center for Community Health and Medical Care, Harvard Medical School.*

Philip J. Judy, Ph.D., Lecturer on Medical Radiation Physics (*Environmental Health Sciences*); *Assistant Professor of Radiology, Harvard Medical School.*

Jack Kasten, M.P.H., J.D., Lecturer on Health Services Administration; *Consultant, Arthur D. Little, Inc., Cambridge.*

Ann Randtke Kennedy, S.D. in Phys., Assistant Professor of Radiobiology (*Physiology*).

Ralph Leo Kent, Jr., S.D. in Bio., Lecturer on Biostatistics; *Assistant Staff Member, Forsyth Dental Center.*

Nathan Keyfitz, Ph.D., Andelot Professor of Sociology in the Faculty of Arts and Sciences and of Demography in the Faculty of Public Health (*Population Sciences*); Acting Director of the Center for Population Studies.

Richard Clark Killin, LL.B., Member of the Faculty of Public Health; Special Assistant to the Dean.

Stephen William Lagakos, Ph.D., Assistant Professor of Biostatistics; *Statistician, Sidney Farber Cancer Institute.*

Nan Laird, Ph.D., Assistant Professor of Biostatistics.

Philip Todd Lavin, Ph.D., Assistant Professor of Biostatistics; *Statistician, Sidney Farber Cancer Institute.*

David Evan Leith, M.D., Associate Professor of Physiology.

David Hugh Leith, S.M. in Chem. Engin., S.D. in Env. H., Assistant Professor of Environmental Health Engineering (*Environmental Health Sciences*).

C. Robin LeSueur, M.L.S., Member of the Faculty of Public Health and the Faculty of Medicine; *Librarian in the Francis A. Countway Library of Medicine.*

Richard Levins, Ph.D., John Rock Professor of Population Sciences.

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